APRIL

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

1934

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Dental Research—*Denton*
Professional Training—*Wherry*
Selection of Artificial Teeth—*Hooper*
Influence of Sun on Teeth—*Lindsay*
Oral Infection and Systemic Disease—*Post*
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Family Dental Practice—
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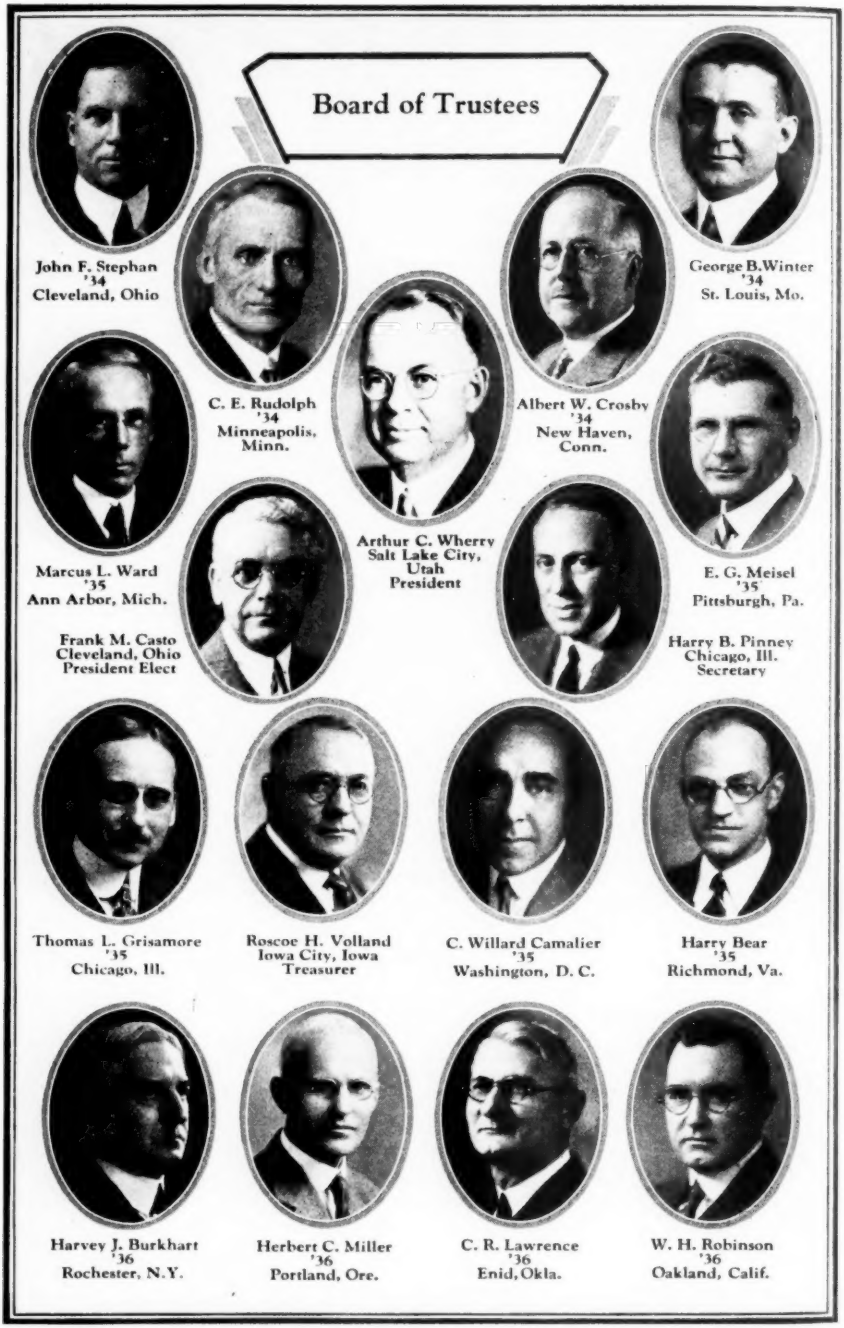

BOARD OF TRUSTEES OF THE AMERICAN DENTAL ASSOCIATION, 1933-1934

THE JOURNAL
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Vol. 21 APRIL, 1934 No. 4

Original Communications

TREATMENT OF PROXIMAL CAVITIES IN THE ANTERIOR TEETH WITH GOLD FOIL*

By WALDEN I. FERRIER, D.M.D., F.A.C.D., Seattle, Wash.

THE treatment of proximal cavities in the anterior teeth requires a most exacting technic regardless of what filling material may be indicated.

The carious area to be restored is comparatively small and difficult of access. It is triangular, the apex terminating between two rather fragile plates of enamel supported by a minimum amount of dentin in which to secure anchorage. Frequently (and more frequently since the introduction of silicate cements), with the third lingual wall entirely broken down, a greatly weakened incisal angle is left on which he must depend for strength to form one point of anchorage to stabilize the operation. The base of the triangle, or gingival wall, forming the remaining and principal area of anchorage is fortunately in a sufficient amount of dentin to give resistance to dislodgment, and the restoration and cure of the diseased surface are made possible. To add to the difficulties, the area to be restored is closely hemmed in and guarded from approach by its approximating neighbor on one side and the vital organ of the tooth on the other side.

Considering these difficulties, and urged on by the exacting demands of an uninformed public for a restoration that harmonizes with the tooth structure in hue, is it any wonder that the great majority of our profession have turned to the use of a plastic that, for a short time, harmonizes with its surroundings, masquerading usually under a false name on its way to the final destruction of the pulp organ, if its use be persisted in?

The frequency of occurrence of cavities in the proximal surfaces of anterior teeth is perhaps greater than is commonly recognized. I have not exact data, but the following will give some statistical authority for the presumption that they are to be classified as cavities that most

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 10, 1933.

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frequently occur. To determine the frequency of occurrence of eroded areas in the human teeth about two years ago, I requested a study club of twelve men with whom I have been associated for a number of years to compile data on their gold foil operations for the past ten years. The results gave me a good basis on which to make an estimate as these men use gold foil in the restoration of nearly all eroded areas on the gingival third of teeth. The same compilation will serve to give a somewhat less accurate estimate of the percentage of cavities that occur on the proximal surfaces of anterior teeth as compared with the percentage that occur on the other surfaces of the teeth.

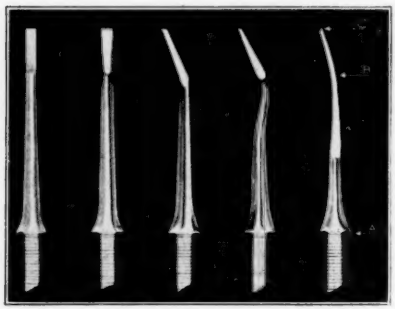

Fig. 1.—Cutting instruments redesigned to better meet requirements of modern cavity preparation.

Following is an accurate record of 12,000 gold foil operations made in the past six to ten years. Some of these reports covered six and some ten years: Class I, 17.25 per cent; Class II, 9.17 per cent; Class III, 37.3 per cent; Class IV, 4.17 per cent; Class V, 32.03 per cent. It is evident that 37.3 per cent, or the largest number of fillings, were placed in Class 3 cavities; and 4.17 per cent in Class IV, a total of 41.47 per cent in cavities in the proximal surfaces of the anterior teeth. The inaccuracy of these data lies in the fact that many cavities not here recorded were probably filled with some material other than gold foil, this unbalancing the record. It does serve to show the comparative number of gold foil fillings placed in the anterior teeth by a group of men who give particular attention to operative dentistry and whose practices would afford a cross-section of the type of work that comes to most practitioners of this day. It should serve to emphasize that not all have lost sight of the excellent and unexcelled qualities of gold foil as a filling material and that the public is not so adverse as it may seem to be to the presence of gold foil in the proximal surfaces of the anterior teeth.

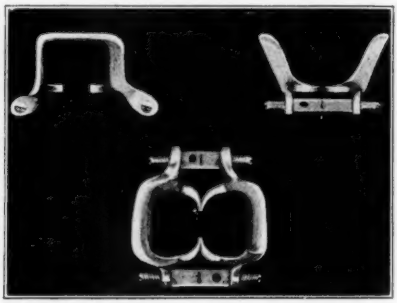

Fig. 2.—Separators designed for more nearly universal application with minimum of operative interference.

In giving the indications for the use of gold foil in the anterior teeth, I can do no better than quote from a paper written about seven years ago on this subject as applied to all the teeth. The indications as thus given I have no reason to change. They now represent the observation and experience of more than twenty-five years devoted mainly to the practice of operative dentistry and give evidence that there is a large field for the placement of foil in the anterior teeth.

It is not advisable to make this class of operation for children or early adolescents where

the time consumed would make the operation so fatiguing as to cause a future experience to be looked upon with dread by both the patient and the operator. The teeth of these patients, or rather the peridental membrane and alveoli, do not offer the resistance to the hand pressure and mallet blows necessary to insure a well condensed mass of gold. The same may apply to those who have undergone a long period of treatment by the orthodontist and whose teeth have not as yet become firmly fixed in the alveolar process as they will in adult life.

Patients suffering from pyorrhea alveolaris or those who from any cause may have lost considerable of the alveolar process and supporting tissues are not to be classed with those for whom gold foil is indicated. Devitalized teeth will be retained longer if not subjected to a prolonged period of malleting. Then there is that class of nervous individuals who for

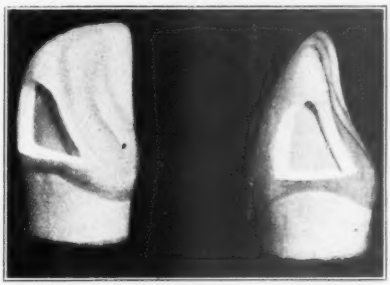

Fig. 3.—Class 3 cavity proximal surface of upper central incisor showing straight gingival wall at right angles to long axis of tooth. The square cut at the linguogingival angle forms the linguogingival shoulder.

some unknown reason are unable to tolerate the continuous blow of the mallet; their appointment is a perplexity to them and a trial for the operator; happily for the latter numbers are few—so few as to be almost negligible. Gold foil is decidedly contra-indicated for them. At the other extreme to off-set their number it would seem we have that sanguine type who peacefully slumbers under the rhythmic blow of the mallet. Most gold foil operators have experienced many such patients and personally I wish their numbers were more; for them, temperamentally, gold foil has a decided indication.

The extent of decay or the amount of tooth to be restored is one of the most important factors in determining the kind of filling material to be used in the operation. The greater the amount of tooth structure to be restored, the less is gold foil indicated; the less the amount of decay the greater the indication for gold foil. This we may take as an axiom. It is unwise to require a patient or a tooth to undergo a prolonged period of malleting and finishing, occupying so much time as to weary the patient, and subject the tooth to such shock as to endanger its vitality later.

Our judgment as to what filling material to use in the human tooth should be and is better than that of the patient; but there is no denying the fact that many people will not tolerate the use of gold foil in the anterior teeth. In some cases, I am unable to understand this aversion

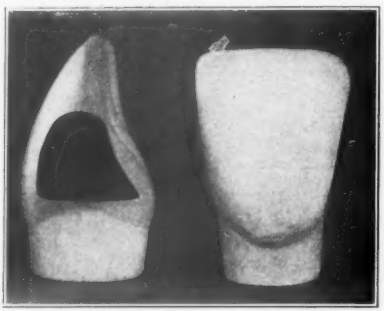

Fig. 4.—Completed operation showing straight labial outline form parallel with distal lobe of tooth.

to a material of such proven quality. In others, the modern conception of esthetics as applied to the teeth makes it necessary to use a material more compatible in color with the tooth, though it cannot compare in permanency or in any of the other requirements of a filling material, except color. In the majority of cases so treated and in which the filling has been in service for any considerable length of time, the inharmony of color is so plainly evident as to create a curiosity on the part of an observer as to just what is wrong with these teeth: Are they decayed? Are

they stained and unclean? Or do they just require the services of a dentist? Perhaps the last is the correct surmise. The patient does require the services of a dentist, with all the attainments, with all the skill, and with all the professional responsibility that the name implies, for he is on the high road to the loss of his teeth if he insists on the use of such substitutes for the best or is led to believe that he is receiving the best, when in reality, to borrow a medical term, a nostrum is recommended that will soon show itself to have been an unwise choice.

This has no reference to the skilled porcelain operator, who has labored long

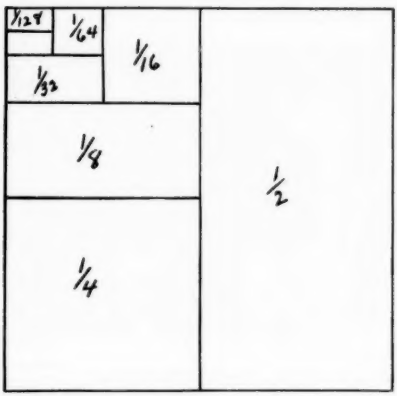

Fig. 5.—Sheet of No. 4 noncohesive foil divided into various sizes for most convenient use.

to perfect an exacting technic whereby he may restore lost tooth structure in its true color with a substance that will not disintegrate, and that will maintain interproximal contact and protect the pulp, which a substitute would tend to destroy.

The indiscriminate use of silicate cements, I think that I can say without fear of contradiction from the informed, has been a contributing cause of loss of more dental pulps, with subsequent focal infection and loss of the anterior teeth, than any other single condition existent since the advent of its use. To our everlasting embarrassment, the innumerable prosthetic pieces both fixed and removable that are now worn to restore teeth in the anterior part of the mouth had their incipiency in the unwise application of the silicate cements, creating to a greater or lesser degree the very condition we wished to obviate; namely, inharmony in appearance of the dental organs.

I do not censure the dental profession for all of the abuses of the silicate cements. The public demanded it, once it was cunningly brought to their attention. Comparative ease of manipulation and economic necessity under many circum-

Fig. 6.—Portion of gold inserted in linguogingivo-axial angle in beginning operation.

stances demanded its use. Moreover, the silicates are valuable to us in practice and have certain distinct indications which are not within the scope of this paper; but surely we should make some effort to limit them to these indications and not be led on and encouraged by the few cases of successful application that all of us have observed. In the light of long experience with the far-reaching deleterious effects of these materials, there is a crying need that someone devise a porcelain inlay technic that the average man may use, reserving the silicates for their proper and rightful indications.

Despite the fact that gold foil has fallen into disfavor in the anterior teeth, there are many who have no objection to its use. These patients, who are usually in middle and late adult life, desire the best material that we have to save their teeth. For these very practical people, gold foil is indicated. I do not wish to convey the idea that this is the only class of patients for whom gold foil is indicated, but rather to emphasize the indication. In fact, gold foil may and should be used in the proximal surfaces of all the anterior teeth, upper and lower, where its size, shape and color does not make it so conspicuous as to offend the esthetic sensibilities of the patient; the operator bearing in mind the contra-indications before given.

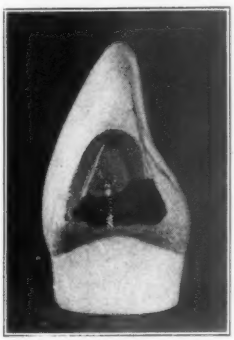

Fig. 7.—Gold built across gingival wall and anchored into labiogingivo-axial angle.

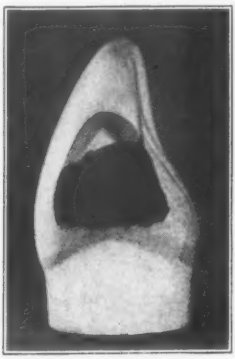

Fig. 8.—Gold built up to incisal angle. The critical point of the operation is just ahead.

With the unsatisfactory experience that so many of our patients have had with other types of operations, it is gratifying to note the rapidly increasing numbers that come under this classification. Perhaps these trying times, when so many have lost so much, have been a deciding factor in the determination to at least save the teeth, and turned them to the one sure means of so doing—the application of gold foil in the hands of a skilled operator. Whatever may be the cause, it is evident that there is an increasing demand from the public for this type of operation; and to substantiate this fact, I need only to call attention to the increasing interest in the dental profession, and the demand for instruction in advanced technic by serious-minded men who wish to be prepared to render the best service for that future which is sure to come.

I could go on indefinitely enumerating my many reasons for believing that gold foil is coming back into its own, to occupy the high position and rank it held in earlier dental practice before the advent of methods that have been abused and never were intended to displace gold foil, but to be used as aids in the preservation of the human teeth. The demand of the colleges for instructors to render service limited to this type of work; the large number of study clubs organized for, and functioning exclusively in, the use of gold foil technic—all attest to these facts.

TREATMENT OF PROXIMAL CAVITIES IN THE ANTERIOR TEETH WITH GOLD FOIL

To treat these cavities properly, it is absolutely necessary to have at our command instruments, devices and operating

aids that have come down to us from a time when dentistry as a profession was in its infancy. The fact that they are old makes them none the less useful, just as the printed page, an old means of conveying and perpetuating the thoughts and ideas of mankind, is not obsolete.

The day the rubber dam was introduced to the profession marked a new era in the study of decay in the human teeth and made possible a method of operation that, in the light of long experience, has proved to be so nearly perfect that the surface upon which we operate is insured against the progress or recurrence of the disease for the lifetime of the patient. I shall not attempt to enumerate the various reasons for the use of the rubber dam. This has been ably done by Dr. Prime in recent lectures that are published and available—about forty reasons in all. I can only add that a cavity preparation for any operation is more easily and best made when the rubber dam is employed.

The cutting instruments of two decades past were better suited to our purpose than those in general use today. The principal cause for the decadence in instrument design, as I see it, is the lack of standardization in measurements and careful consideration of instruments so shaped that all the desirable qualities possible would be assured for shaping cavities for the reception of fillings and eliminating undesirable features. (Fig. 1.) With this in mind, I have recently assembled a set of instruments suitable to my own needs, selecting them from existing forms and redesigning them in sizes, shapes and angles more applicable to modern cavity preparation. The design was intended to eliminate all the spring possible from the instruments consistent with strength, and this is mainly accomplished in the shaping of the shank, the angle and the upper part of the blade. The diameter of the instruments at the necks and angles varies according to the purposes for which they were made; for example, a Black's binangle chisel would be greater in diameter at the angle than a small hoe, the chisel being called on for heavier work in larger openings than the hoe. All of the hatchets and hoes are

Fig. 9.—Gold filling incisal angle and anchored to main body of gold already placed. The filling should now be safe from dislodgment.

Fig. 10.—Appearance of filling at making of turn. Great care should be exercised at this point.

made small enough from the shank down to the cutting edge to enter the smallest cavity we are called on to make with them and yet so shaped as to eliminate all spring consistent with the strength necessary to resist breakage from the force commonly exerted by good operators.

I found in designing these instruments that the thickness of the blades at their cutting edge was the most important measurement as it is with this part of the instrument that most of the work is done. I therefore standardized this dimension, giving it a thickness of 0.012 inch for all the instruments of the set except the spoons and the 3-2-28 hatchet. Thus, it is possible for the instrument maker to have a standard measurement from which to shape the blade in addition to the formula of Dr. Black or such variations of these formulas as I have seen fit to make for my own use.

The blades of practically the entire set of forty-two are slightly beveled from the face to the back so as to present sharp angles on each side, this giving three usable cutting edges to each instrument so that they all may be used as hoes in addition to the special requirement for which each was made. When pairs are used, the handles have a small flat indentation on the side directed toward the cutting edge and the contrabevels are marked with small grooves cut around the shank. With these distinct markings, in addition to a serial number placed upon the handles, no confusion is experienced in selecting the instruments required at the moment, if they are filed in the cabinet in numerical order. The selection merely suits my individual requirements; the principles of design may be incorporated in any instrument used for cutting tooth structure.

Fig. 11.—Gold completely placed.

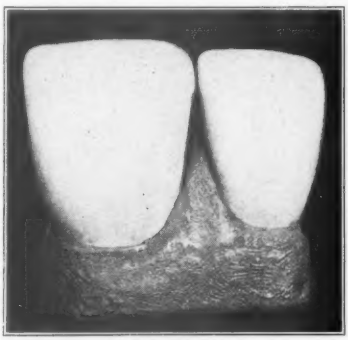

Fig. 12.—Finished operation. Only a small amount of gold is visible.

Of such importance do I consider well selected and designed instruments that I used two months of my spare time, with the assistance of an instrument maker, to complete a work that could be accomplished only by the laborious system of trial and error. The increased efficiency gained by myself and many others has more than repaid me for my efforts.

While it is not necessary that all teeth in the anterior region be separated by mechanical means in order to gain access for operation, it is advantageous in a very large majority of cases; and rather

than lose the time that any change in a standardized technic may cause, I prefer to separate mechanically nearly all the cases that are in normal or nearly normal relation. The set of six separators, as originally designed by Dr. Perry, have thus far been best suited to the purpose. But for the past fifteen years, these have not been available. To fill an indispensable need, I have for the past year been working, as time would permit, with the assistance of an instrument maker, to redesign these separators, with the hope that an improvement could be made in them. The working models in substantially the same design as shown in the mechanical drawings have been in use in my office for the past six months. They are more widely applicable than the original design and give far more working space and freedom from interference. (Fig. 2.)

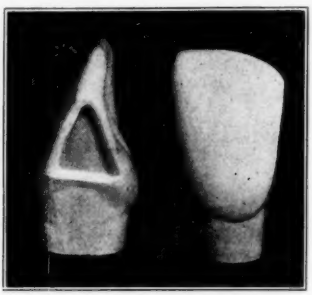

Fig. 13.—Class 3 cavity in distal surface of upper lateral incisor illustrating variation from typical preparation shown in Figure 5. This preparation is indicated in about 70 per cent of lateral incisors.

That we may appreciate the work of the men who originally designed instruments and appliances used in operative procedure, permit me to say that, in the redesigning of these separators, from seven to fourteen hours of hand work was necessary to make one working model; for one of the separators, fourteen separate models were made in order to arrive at the design best suited to our purposes, and for the set of six, the number of models made for each varied from two to fourteen. If this is any criterion of the efforts expended by the original designers of instruments and appliances used in our work, we indeed owe a debt of gratitude to those men of an age past.

With the rubber dam adjusted, the field of operation is inviting. The septal gum tissue between the teeth is retracted by the continuous pull of the elastic rubber, which excludes all moisture. By the inclusion of the six anterior teeth, freedom from interference by the rubber is assured, and a typical cavity is prepared in the distal surface of an upper central incisor. (Fig. 3.) If the decayed area is small, a small round bur is used for opening up and making room for the hoe 6-2-6. This instrument is used to break down the enamel and partly form the labial and gingival wall. A small invested cone bur is now introduced and a cut is

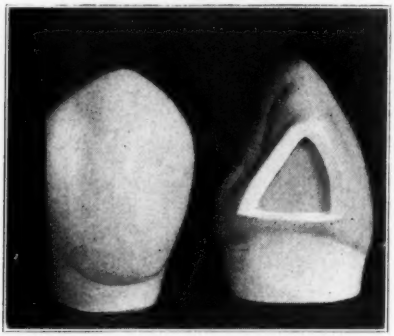

Fig. 14.—Class 3 cavity preparation in distal surface of upper cuspid to be used in all cases wherein incisal angle may be cut so as to receive bayonet plugger at proper angulation to deliver force; used in large majority of cases. Here the variation becomes the type.

made from the center labially and then lingually to outline and roughly form the gingival wall and definitely establish the linguogingivocavosurface angle to the form of a slight shoulder. Usually this is the only need that we have for a bur in this preparation. The 6-2-6 hoe is now used both as a chisel and as a hoe to establish the remainder of the outline form. With the same instrument, the resistance, retention and convenience form is made, with removal of the carious dentin and finishing of the enamel wall. In fact, the entire cavity preparation may be made with this useful little instrument, which has been designed to lie in the cavity at such positions as are necessary to cut and shape the walls and the angles. It is probably more convenient to use other instruments specially designed for various parts of the cavity, unless one is very familiar with the use of the hoe. The small angle formers may be used to make the point angles. The 3-2-28 hatchet may be used to form the incisal angle, and the 3-2-28 hoe to form the labio-axiogingival point angle and the axiogingival line angle. Convenience points may be made with a very small spear pointed drill. The outline form may be completed and the enamel wall finished with a small contrabevel Wedelstaedt chisel. To give a detailed technic of the instrumentation in this cavity preparation is not within the scope of this paper; but, in actual practice, a technic has been developed each step of which follows the preceding one in a logical sequence that is seldom varied.

Let us examine the completed cavity in some detail, emphasizing the salient points of advantage that make it approach the ideal for the purpose for which it was intended. (Fig. 4.) The labial outline form presents a straight line for the extent of its gingival two-thirds to such a point that its labiogingival angle is placed under the free gingiva, if this be in normal relation. On the incisal third it presents a curve that blends in with this line symmetrically. This outline, when completed, closely approaches the mesiolabial angle of the tooth, this depending on the size and shape of the tooth and its po-

Fig. 15.—Dr. Prime's preparation employed where marginal ridge of first bicuspid prevents application of proper line of force into incisal angle.

Fig. 16.—Cavity preparation from proximal surfaces of lower incisors. The lingual wall is not removed and its cavosurface angle remains on the proximal surface. The cutting is reduced to the absolute minimum.

sition in the arch. Here, it will reflect the light and not appear as a dark stain if it is held in too closely to the center of the tooth. Here it parallels and is in conformity with the lobe of the tooth, which is the only distinctive marking adjacent. It is in pleasing harmony with the size and shape of the tooth and is not nearly so conspicuous as one might think before the completion of the operation.

The lingual outline form closely follows the labial and meets the gingival in a square and sharp angle, forming what I term, for the sake of euphonic description, the "gingival shoulder." Owing to the many failures in Class 3 operations, I have long felt that a more convenient lin-

Fig. 17.—Labial view in Class 4 operation. This is the only outline form used and gold foil operations are employed here in only very favorable cases.

guogingivocavosurface angle should be adopted than the one that is held in closer to the center of the tooth. Into this angle, we may mallet the foil most conveniently; if not to our satisfaction from the labial approach, then from the lingual, where we have a direct drive that insures close adaptation of the foil. I could compromise on any other feature of this cavity preparation should I be convinced that such compromise was an advantage to the patient, but not on the "gingival shoulder," which is indispensable to my technic. It is not new, in a comparative sense. One of my fondest memories is the occasion on which I exhibited it in a practical case to the late Dr. Wedelstaedt and received his studied and rather reserved approval, more than twenty years ago.

The gingival outline form is cut straight across at about right angles to the long axis of the tooth, not curved with its convexity toward the incisal as formerly. As this convexity is not so easy to form as a straight line and offers no especial advantages, in the interest of simplicity and an ever-increasing tendency in the past few years to a smaller and more con-

Fig. 18.—Lingual view in Class 4 operation.

servative cavity preparation, the curved gingival line has been abandoned in most cases. It calls for a longer labial and lingual wall, obstructs the view of the lingual third of the cavity and presents an obstacle around which to mallet. The gingival cavosurface angle meets the labial in a definite manner, but the severity of the sharp angle is relieved by a slight rounding made in the enamel when these walls are made true in the finish of the cavity preparation.

Much of the resistance form and nearly all the retention form are made

between the gingival wall or base of the cavity and the incisal angle. This wall and angle meet the axial wall at a right or slightly acute angle and give all the stability and resistance to stress necessary. The labial and lingual walls meet the axial walls at an obtuse angle and offer little resistance and less retention. These walls remain much stronger when shaped this way.

This cavity preparation presents no unusual difficulties to the experienced operator. The foil is easily and quickly placed if a careful technic is observed. (Fig. 5.) A $\frac{1}{64}$ pellet of a No. 4 cohesive gold, prepared after the accepted manner of most gold-foil operators is placed in the linguogingivo-axial angle and malleted to place with a small round plugger 0.4 mm. in diameter with a mallet in the hands of an assistant. Successive pieces are placed until the angle is filled up to its cavosurface bevel. (Fig. 6.) The foil is now carried along the gingivo-axial angle to the labiogingivo-axial angle and tied in with a few small pellets. (Fig. 7.) We now return to the lingual portion of the cavity and build the gold along the axiolingual angle almost down to the incisal angle, using care to keep the foil highest toward the lingual and gingival walls. (Fig. 8.) A separator of the Perry type must be applied to gain better access and insure a proper contact point. The gold is now carefully worked along the axial wall and into the incisal angle, completing most of the anchorage that the filling is to have.

We have now reached a critical point in the operation. (Fig. 9.) That portion of the incisal fourth that remains to be built to proper contact and contour will rest upon the enamel and requires delicate manipulation, yet firm enough to well condense the gold. I have termed this procedure "making the turn," for that is indeed what we are doing—making a turn of a half circle in instrumentation to get a proper line of force. Some hand pressure may be used in this incisal region, but it usually can be supplemented with mallet force upon a small bayonet-shaped plugger. Indirect wedging is permissible and desirable in some locations; but usually force applied at nearly right angles to the wall is best in this situation. As there is but a small bit of gold to be placed, such force is allowable, although, generally speaking, a line of force inclined toward the long axis of the tooth is the best one to use throughout the operation. Some license away from the orthodox must be granted in difficult and unusual situations. With a small bayonet plugger the "turn is made" and the remainder of the operation (Fig. 10) presents no exceptional difficulties. With an improper technic, an inoperable case is often made by cutting off the field of operation with the foil. Sufficient separation, care in the placement of the foil and proper instrumentation will insure good margins and a well-condensed filling at this point. (Fig. 11.)

To finish this operation requires a little more separation (never enough to cause any great discomfort), in order that a thin metal abrasive strip may be passed into the interproximal space. This is followed by long linen strips of various grits until hard dense gold is reached to serve as the contact point. Files and knives are now used to bring the gold down to its margins, when the final finish is made with strips. A disk is rarely used, as a strip will give better contour, and more rapidly, when cooled by the compressed air blast.

The labial outline of the finished filling is in harmony with the distinctive markings and the size and shape of the tooth. (Fig. 12.) It should not offend the esthetic sensibilities of the patient or his friends, and the surface of that tooth

is rendered immune to decay under ordinary circumstances for the lifetime of the individual. Do you know of any other operation for which so much could be claimed?

I have shown a typical Class 3 operation, and with some hesitancy I show some variations from the type. It has been my experience in lecturing on this subject and in practical instruction to graduate dentists that when variations from type were shown, confusion and misunderstanding was the result. The variation was given more important consideration than the type and was frequently substituted when the typical operation was indicated. On other occasions, if some modifications of the standard preparations were not shown, the impression was given that all cases themselves were to be treated in a stereotyped way. We must have a standard and modify this standard to suit the conditions met in practice. Some of the more important variations from type are here given, largely in an illustrative way, with short references in the text to the illustrations.

The distal surfaces of upper lateral incisors call for a modified and a simple preparation, when they occur with the disto-incisal angle well rounded. (Fig. 13.) The contact with the opposing tooth is nearly on the curved surface that makes up the angle. These are simplified and more nearly immune and are improved esthetically by the cutting away of the angle. A direct drive with the plugger can be obtained throughout the operation, and thus "making the turn," described in the typical preparation, can be avoided. A typical outline form established here would give the impression of two opposing curves, one the incisal outline form of the cavity and the other the curve of the angle of the tooth. This is out of harmony with all the distinctive markings of the tooth and does not meet the esthetic requirements.

To a very limited degree, this may apply to the distal surfaces of certain central incisors and to the mesial of some cuspids, and here for an additional reason. The shape of the cuspid makes it very inconvenient to reach through from the labial or lingual approach to the opposite side of the tooth, and we experience difficulty in condensing the middle third of the filling. Where permissible, an incisal approach is desirable. For these reasons and others, the distal surfaces of upper cuspids require a similar preparation, and for this tooth, the variation becomes the type. The filling of this cavity, once considered the most difficult to fill in the human mouth, with proper cavity preparation becomes just an ordinary procedure. This type of cavity can be used only where the incisal angle or wall may be established in such position that the marginal ridge of the first bicuspid does not preclude a proper line of force with which to condense the gold. Finished, these fillings are often smaller than typical ones in central incisors. The angle at which the gold is finished incisally literally sheds any force that would tend to dislodge it.

I find this preparation indicated in by far the majority of cases. There are conditions that prevent foil from being well placed in the incisal angle of this preparation and a special one must be used. I prefer and use to the exclusion of all others the one here shown that was designed by James Mark Prime, of Omaha. (Fig. 15.) I know there is no mistake in this preparation as illustrated, as he carved the model himself and gave it to me several years ago. I will not attempt to describe it as I might not do it justice.

Time will permit me to describe but superficially cavities in the lower anterior

teeth. In the lower incisors, the lingual wall is usually left standing and as much strength left for the incisal angle as possible. These surfaces are usually immune and a very conservative preparation is made.

Cases in which the incisal angle involved offers no special difficulties in operating other than that they require considerable time in placing the gold. The older types of cavities are too conspicuous to be tolerated by the majority. The illustration given here better meets esthetic requirements. (Figs. 17 and 18.) They are only to be made in selected cases as experience teaches that they will not stand biting stress over a long period of time. The gold will stretch and a leak will appear at the incisal angle.

The foregoing is a description of the technic that I have used for more than twenty years, with such slight changes as I have seen fit to make in cavity design, always toward the conservation of the tooth structure. It is practical and it is teachable, being employed by more than seventy-five study club men in the Pacific northwest alone. I have made every effort to standardize it and reduce it to such simple requirements that the practitioner of average ability can apply it in his every-day work.

Did it not possess these qualities, the technic would be of little value. For me and for these men, it has merit, but it is not the only technic for assuring good gold foil operations. There has been close cooperation between the gold foil operators. For many years, they have defended a method of operation that might otherwise have been lost to the profession. Their numbers were few and are comparatively few now, but they were steadfast in their beliefs and firm in their purpose and are now receiving the encouragement that comes to those who see their work more generally adopted.

All that stands between the modern gold foil operators is a small shaving of enamel, not enough to add or detract greatly from the appearance of the filling and not enough to weaken the tooth or endanger the pulp in any way. I hope that this slight bit of tooth structure may not magnify itself to such unwarranted proportions as to cause a breach in the happy relations that now exist and that have had no small part in the renaissance of gold foil evident at this time.

Medical and Dental Building.

THE PROGRESS OF DENTAL RESEARCH*

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RESEARCH is a term that has become nearly identified with recent and contemporary science. The implication is not that research is merely a new word for science, nor that the concept for which it stands constitutes all of science even today; but rather that the major part of scientific activity—not necessarily the most significant—during the last half century has been so largely of one character as to call for a particular designation, which is supplied by the word "research."

There may be some difference of opinion as to what constitutes research; and there are doubtless those who might contend that true research is identical with science, but we shall all have to admit, I think, that the term has been brought into use largely because it connotes—if it does not denote—certain features more or less to the exclusion of others. Science of the highest order doubtless calls for vision, imagination and speculation. Research of a very useful sort may be done without any of these. Imagination may accompany research, but it is not a vital part of it. Of course, research must have purpose, but often, even in research of a high order, the purpose is imposed from without; the task is set by a hypothesis in the formation of which the research worker had no part.

Research has largely outbulked other phases of scientific work because, in the natural sciences, workers have come more and more to pin their faith to observation, and limited generalization to integrating the observations.

Putting the emphasis on observation, whether experimental or immediate, research has emphasized intensive and extensive methods of gathering evidence. These are evident, on the one hand, in the tendency to repetition, to multiply similar observations, and, on the other, in the penetration into detail and the insistence on exactness of description. Moreover, research is systematic, sometimes devoting itself to the laborious verification of hopeless hypotheses, for the sake of completeness.

Research, manifesting always a critical attitude toward the results of observers, has insisted more and more on the necessity of recording data. This has led in the published research to an increasing necessity to print the evidence, to set forth the details of data and methods of investigation. In this respect, modern research differs much from the work of earlier investigators, the earliest of whom felt that it was necessary merely to set forth their conclusions and only casually to mention the way in which they were arrived at.

All of this assumes that however simple the ultimate answers to scientific problems may be, the solution is not easy. It presumes a painstaking, morsel by morsel, growth of knowledge, by devious routes, and much failure.

Thus research becomes the routine of science.

From the point of view of research,

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scientific problems are not the work of single titanic minds, but fields for cooperative cultivation. Thus, research has a distinctly social turn, and as we shall see, historically the development of its social aspect is most important in its growth and advancement.

Dental research differs from other research only in the fields to which it is applied. Dental research is concerned with problems of dental science and of dentistry. No department—practical or descriptive—is excluded; but this does not imply that all problems have been solved to the same extent by research methods or that all matters have proved equally amenable to treatment by research investigation.

Nobody, apparently, has tried to give a historical account of dental research, and, at the present, any attempt to trace its development and progress from the earliest times to date must be a pioneer work, merely a sketch, subject to correction and amplification.

It may be pardonable, then, to indulge in a little speculation and to analyze the progress of dental research to some extent *a priori,* before attempting to trace its development in detailed facts. Some of the principal influences which have led, and which continue to lead, to research work may be pointed out.

In the first place, the consciousness of a practical need of any sort serves as a constant stimulus to investigation until that need is completely filled. With materials employed in dentistry, wherever scientific inquiry has resulted in change and improvement, it has been the shortcomings in the properties of the existing material in the light of the use to which it must be put that have driven investigators to seek new modifications and substitutes for the old. Likewise, on the descriptive side of dental science, where, for instance, the etiologic factors and pathosis of a dental disease have been regarded as important in the treatment, the practical need to cope with the disease clinically is the most potent stimulus to research. Research usually does not flourish about subjects which do not have some relation to the practice of dentistry, although sometimes special influences may for a time direct considerable research activity into fields less immediately related to practical dental science. Fortunately, unexpected returns from these excursions of interest have amply justified the limited effort of dental investigators that has been bestowed on them.

The second most important stimulus to a piece of research is probably the existence of a hypothesis or a practice already in the field. The existence of contradictory hypotheses or practices furnishes the most compelling urge to research investigation. Research, by verifying the alternatives, comes in as the arbiter of all differences of opinion. After a century of discordant opinion, one substantial piece of research may completely silence all but one theory, and bring about a consensus of opinion.

A third influence consists of developments in sciences allied to the dental, either collateral or basic. The great advances of dental science and practice have, in large measure, been contemporary with the developments of anatomy, chemistry, physiology, bacteriology, pathology, medicine and surgery. The outlooks, the facts derived and the methods of sciences outside the realm of dentistry itself must frequently be waited for, in order that investigation within the bounds of dental science may be undertaken; and the discoveries of these underlying sciences are at once the means and the stimuli of the dental investigator's essay.

With developments in science come new methods of investigation. The invention of new kinds of instruments and

new ways of analysis are almost sufficient in themselves to set investigators to work without other incentive. Dissection, the microscope, chemical analysis, the bacteriologic culture—all have inspired research of the greatest importance to dental science.

Even a new body of material from which evidence may be derived has been sufficient to start valuable research. A fossil animal discovered or the unearthing of a prehistoric burying-ground may initiate an enquiry into the relation of caries to civilization, which otherwise might not be thought of.

The opportunities and means which these various factors afford must, of course, be centralized and embodied in the person of some investigator who has the type of mind, the interest and the training to make use of them in a research investigation.

Finally, among the forces which make for research must be included all agencies, individual or collective, which have fostered research by giving it opportunity, reward or active support. Agencies for the encouragement of dental research must be accounted more and more important in the progress of dental science. Their development marks a growing consciousness, within the profession and without, of the importance of dental research.

Important as research has been in the advancement of dentistry and dental science, it must not be supposed that it is the only means by which progress is achieved.

Especially in procedures and technic, empiricism has been at least equally potent in bringing about changes, and perhaps has even exceeded research in effecting substantial improvement. With trial and error as a method of attack and clinical impression as a judge of results, a large part of practice has changed from time to time. The early formulas for amalgams, before scientific tests of physical properties and physiologic effects were introduced, were largely of this sort. Trial and error was often enough supplemented by the happy thought or accidental discovery, with some most important results, as is exemplified in the case of nitrous oxide anesthesia and Arthur's introduction of cohesive gold foil.

In the earlier years particularly, rationalization was extensively employed as the instrument of construction and criticism of dental theory and practice. Drawing on a knowledge of physics, chemistry, biology and clinical result, the investigator thought his way through to conclusions which, if all his premises were accepted, must be true, and which, often enough, were never carefully verified by observation. This deductive method has by no means been abandoned today in dentistry, and, in the earliest years, it was by far the most generally employed method of scientific inquiry. Perhaps because this rational method came into use so early and the observational became predominant so late, most of our present-day dental controversies have had such a long history. It may not be generally recognized that, for the most part, dental research workers are today engaged in verifying the hypotheses of a century or more ago.

Another faculty in the advancement of dentistry, as in all scientific branches, is imagination or speculation. All scientists, and especially some of those who have made the most far-reaching discoveries, have depended on the recognition of symmetries, analogies, "hunches" and other more or less intuitional suggestions for direction in pushing their inquiries. Possibly the limited scope of the dental field has given less opportunity for this faculty than have sciences of greater scope; but certainly in the field of comparative den-

tal anatomy and paleodontology, imagination has played an important part. Cuvier's restorations of geologic life and Cope's attempts to trace the development of the compound teeth involve imagination to good scientific purpose.

It is proper that we should bear in mind, then, that advance in dentistry and dental science is the product of many forces and various faculties of the human mind: experience, reason, imagination and observation. Research, which is mostly to be identified with the last, is only one, but an increasingly important, factor in dental progress.

To get some notion of the development of dental research, it is best to consider what has taken place in certain large and more or less determinate periods of its history. Although it would be impossible to affix a definite date to the termination of the earliest of such periods, it is convenient to place it in the third decade of the nineteenth century and include all that has preceded from the earliest times. As regards the basic sciences, this is a period preceding the great scientific development of the nineteenth century. Physics and anatomy were the only sciences which had reached any degree of perfection, and chemistry was just beginning to assume form. The biologic sciences, aside from anatomy and the mechanics of physiology, were mostly either in their infancy, as with botany, or practically nonexistent, as with chemical physiology, microscopic histology and bacteriology. In dentistry, it was a period in which the leaders, though men of training and distinction, were concerned mostly with technical procedure rather than investigation. Their science—of which they had no small amount—was mostly derived from workers outside the practice of dentistry. Dentistry was largely unorganized, and its three modern instruments of communication and social inspiration were lacking; namely, dental associations, dental schools and dental journals.

As anatomy was the best developed of the biologic sciences in the first period, most of the dental research was of an anatomic character, and the dissecting knife was the principal instrument of investigation. To this structural study were added some of the more mechanical physiologic phenomena of growth and movement.

Human dental anatomy was, as is well known, established on a basis of careful and minute observation by the naked eye, along with general human anatomy, in the middle of the sixteenth century. It is hardly necessary here to detail the work of the great investigators of that time, including Fallopius, Vesalius and Eustachius. It is only necessary to recall that Eustachius, in 1563, published the first book[1] entirely devoted to the anatomy and development of the human teeth, and that this work, besides correcting many of the errors of the ancients and of his contemporaries, comprised practically everything known today of the structure of the teeth and their physiologic changes that can be learned from gross inspection. The information was secured from cadavers of all ages, to which, in his connection with the great Roman hospitals of S. Giovanni in Laterano and of la Consolazione, he had access in great numbers.[2] Eustachius, and all his co-workers in the field of dental anatomy, were surgeons, general anatomists and teachers. No important work as regards tooth structure was contributed by a dentist.

The work of these anatomists became the source of information for the best instructed dentists. In 1582, Urbain He-

1. Eustachius, Bartholomaeus: Libellus de dentibus, Venice, 1563.

2. Piperno, Arrigo: Bartolomeo Eustachio e il libello "de Dentibus," Stomatologia, 12:11 (Oct.) 1913.

mard, a surgeon, wrote "Recherche de La Vraye Anathomie des Dents," adapting much of the material of Eustachius and others. Even the famous Fauchard apparently derived his anatomic description of the teeth from this source.

Comparative dental anatomy, like general comparative anatomy, lagged behind human anatomy, but became the subject of much research in the latter eighteenth century. John Hunter's collection and preparation of specimens and his writings, most of which never reached print, were among the earliest extensive investigations.[3] Subsequently, in England, came the work of Blake[4] and others, and the extensive work of the Cuviers and their followers in France. It was in Cuvier's study of fossil remains[5] that the paleontology of the teeth first became conspicuous among the sciences. Here, again, the investigators were not dentists. Hunter and Blake were surgeons. The former supported his researches from an enormous income from his fashionable practice; and Blake did his most considerable work as a thesis at the University of Edinburgh (1798). Cuvier had the patronage of the first Napoleon behind his efforts. Hunter and Cuvier are to be ranked among the great minds of biologic science.

The ontogeny of the human teeth was developed to a considerable extent macroscopically by the same sixteenth century investigators, who developed human dental anatomy to such perfection. But, in the developmental field, these early workers had, of necessity, left much to be desired. Hunter and other eighteenth century investigators endeavored by the same gross methods to add the needed details and to make a truer picture of the process. It was Hunter who made famous the staining of developing dental tissues by madder *in vivo,* to discover to what extent the dental tissues were possessed of circulation and metabolic function.[6]

Perhaps the most valiant effort to solve the problem of tooth development by macroscopic study was that of Jourdain in 1766.[7] Jourdain, who was a dentist and surgeon of distinction and founder of oral surgery and stomatology as a specialty of medicine, made an almost desperate attempt to discover the steps in the developmental process. His somewhat fumbling procedure well represents the unfortunate position of a scientific mind capable of coping with the problem but lacking a suitable method of investigation. Jourdain made dissections of fetuses at ages of from 2 months to term and of the cadavers of infants and children. He mentions in one place dissecting 200 embryos and fetuses between the ages of 2 months and 5 months. Nevertheless, the earlier stages of development eluded his most painstaking scrutiny with the naked eye. His magnifying glass, enlarging the image not more than six or seven times, revealed little more. He described the feeling of the tissues between the fingers in various stages of calcification. He resorted to the chaotic chemistry of the time to analyze the tissues into their elements, using various acids, and described the filamentous structures, coagulation, etc., resulting. But, without a microscope and microscopic technic, he arrived at only the vaguest notions of tooth development.

3. Colyer, J. F.: John Hunter and Odontology, London: Claudius Ash, Sons & Co., Ltd., 1913.

4. Blake, Robert: Structure and Formation of Teeth in Man and Various Animals, Dublin, 1801.

5. Cuvier, Georges: Ossemens fossiles, 1812-1813.

6. Hunter, John: Natural History of Human Teeth, 1771, pp. 36-40.

7. Jourdain, A. L. B. B.: Essais sur la formation des dents, comparée avec celle des os, 1766.

Something was also done by research methods in the study of the development of animal teeth. Throughout the first period, the investigation which would probably most nearly fulfil the demands of modern research was comprised in a series of studies by Tenon on the development of the teeth of the horse, extending from 1767 to 1807. Tenon, besides being a surgeon of the highest distinction, was also a member of the Académie des Sciences and later of the Institut de France, before which learned bodies he presented his memoirs. The two principal ones, of 1767 and 1770,[8] were presented as examples of what he regarded as a new method of studying the organs of the body; that is, since the organs are not static but developing structures, presenting their structure at different stages from their origin through their maturity to their ultimate decline. He employed dissection and simple measurements. His chief conclusions with regard to horses' teeth were these: The completed tooth of the horse never exists in the mouth at one time. A large portion of the molar surface is worn away before the roots are completed. The tooth continues to grow and thus move occlusally as its molar surface is worn. After the roots are completed, the tooth continues to drift occlusally, until the root fragments are exfoliated.

One of the problems which caused much discussion among dental scientists during the latter part of the first period was the question as to where the development of bone took place in the growth of the jaws and dental arches. John Hunter apparently was responsible for the earliest hypothesis, which was pointed out and illustrated in his "Natural History of the Teeth"; namely, that the succedaneous permanent teeth have no more space for their accommodation than had their predecessors. Immediately, dentists, whether investigators or practitioners, were divided into the partisans of Hunter's proposition and those who believed that there was horizontal growth in the anterior segment of the jaws as well as back of the second bicuspid. Neither Hunter nor his immediate successors on either side of the controversy furnished convincing observational evidence, relying largely on plausible reasoning. After forty years of fruitless discussion among dental writers, Oudet recognized that only research would bring about a solution satisfactory for everybody. In 1824, he presented before the Académie Royale de Medecine his results from a study of impressions of the arches of twenty children at 3 years of age and at later periods.[9] He pronounced in favor of Hunter. In support of the hypothesis that development also takes place in the anterior segment, Delabarre reported on studies made on children in l'Hôpital des Enfans and l'Hospice des Orphelins.[10] He made measurements by means of wires and threads of the space occupied by the six anterior teeth at 2 years of age, and at yearly intervals through the seventh year. From these results and others obtained from the use of wax models, he concluded that Hunter was wrong. Delabarre, in reply to Miel,[11] one of his opponents, remarked

8. Tenon, Jacques-René: Une méthode particulière d'étudier l'anatomie, employée, par forme d'essai, à des recherches sur les dents et sur les os des mâchoires, Mém. de Math. et de Physique, 1790, pp. 558-588. Second essai d'étude, par epoques, des dents molaires du cheval, ibid., 1790, pp. 589-622.

9. Footnote to J. E. Oudet's translation of Bell's edition of Hunter, John: Natural History of Human Teeth, 1839 (?), pp. 69-72.

10. Delabarre, C. F.: Méthode naturelle de diriger la seconde dentition, appuyée sur les preuves de l'agrandissement de la partie antérieure de l'arc maxillaire, 1826.

11. Miel, E. M.: Quelques idées sur le rapport des deux dentitions et sur l'accroissement des mâchoires dans l'homme, Mém. de la Soc. M. d'Emulation, 7:426-444, 1811.

that if the latter "would exchange his ingenious geometrical figures for the scalpel . . . he would be convinced."[12]

The movements of the mandible furnished a problem for the anatomists of the eighteenth century, who were not at all concerned with applications to practical dentistry. Ferrein, a distinguished anatomist, in 1744 presented before l'Académie Royale des Sciences, a memoir on "The Movements of the Lower Jaw."[13] Accomplishing most of his demonstrations by means of digital examination of the living subject while performing the various movements of the jaw in chewing, swallowing and speaking, Ferrein was able to determine the character of all the movements of the mandible recognized today, and to analyze them in accord with the best established conclusions of our own time. Well-instructed dental writers, beginning with Jourdain, in 1784,[14] were familiar with the problem, the general nature of jaw movements and its application to the problem of retention of artificial dentures. With Maggiolo, in 1807,[15] and Delabarre, 1820,[16] the principles of jaw movement were studied and employed in the improvement of the intermaxillary springs used to retain full dentures. With the decline in the use of springs and the development of "atmospheric plates," the accomplishment of Ferrein seems to have been lost by the dentists, and the problem of the movements of the mandible arose a second time in 1858 when Bonwill recognized its importance in relation to articulation of the teeth as a factor in denture retention.[17] It is remarkable that research in this field did not yield results equal to those of 1744 until about 1910, when Alfred Gysi again presented a comprehensive view based on research.[18]

The study of pathologic dental conditions in the first period was almost entirely clinical, and very little was done that might be called research. There was the beginning of a scientific study of caries. One of the greatest errors regarding the etiology of tooth decay was dealt with in a thoroughly scientific way. The theory that caries is due to the destructive action of worms in the teeth was prevalent among both the ignorant and the learned till the end of this period; and considered apart from our present-day knowledge of facts, there is nothing impossible or absurd in the theory. The investigation of Jacob Christian Schaeffer,[19] although it did not attempt to attack the validity of the theory itself, did much to discredit it by showing conclusively for the first time that the so-called worms produced in the treatment of toothache by means of burning henbane seed were not worms at all, but the expanded germs of the henbane seeds themselves. Historians have shown a tendency to belittle

12. Delabarre, C. F.: Méthode naturelle, etc., 1826, p. 8 (note).

13. Ferrein, Antoine: Sur le mouvement des deux mâchoires pour l'ouverture de la bouche; et sur les causes de leurs mouvements, Hist. de l'Acad. Roy. d. Sc., Année 1746, 62:509-552, 1748.

14. Jourdain, A. L. B. B.: Reflexions sur la construction et les usages des rateliers complets et artificiels, J. de Med., Chir., Pharm., etc., 62:283-290, 1784.

15. Maggiolo: Le manuel de l'art du dentiste, 1807, pp. 154-159.

16. Delabarre, C. F.: Traité de la partie mécanique de l'art du chirurgien dentiste, 1820, pp. 430-431.

17. Bonwill, W. G. A.: Articulation and Articulators, Tr.A.D.A., 1864, pp. 76-79.

18. Gysi, Alfred: Problem of Articulation, D. Cosmos, 52:1-19 (Jan.), 148-169 (Feb.), 268-283 (March), 403-418 (April) 1910.

19. Schaeffer, J. C.: Die eingebildeten Würmer in Zähnen, nebst dem vermeytlichen Hülfsmittel wider dieselben, Regensburg, 1757.

Schaeffer's essay, pointing out that he was an Evangelical clergyman and not a dentist, and that he was in truth only knocking down a man of straw. It is true that he was a clergyman, but his claim to fame rests upon a long line of works of natural science mostly of the descriptive and cataloging sort in the field of botany and entomology. He was a member of several scientific societies and is remembered as the first to produce satisfactory descriptions of fungi. His work on the worms in the teeth represents the application of simple, logical methods of experimentation in which one factor in the complex to be analyzed is altered at a time. Beginning with the presumption that the alleged worms are derived from the teeth, he demonstrated, step by step, that, in spite of appearances, they could not be as assumed; what their true nature was, and how the illusion was produced. Schaeffer's work may be regarded as a valuable negative result clearing the way for more promising hypotheses.

Among the hypotheses about which opinion began to center in the nineteenth century was that of the chemical cause of tooth decay. Although enunciated very early in crude form, the first attempt to demonstrate it in any measure by experimental means seems to be in a fragmentary work of S. L. Mitchill, distinguished professor of chemistry in Columbia College, New York, reported in a letter of 1798.[20] Mitchill concluded that dental decay was probably produced by septic (that is, nitric) acid. Apparently, he did not subject the teeth themselves to the effects of this acid, but from the action on calculus inferred the relationship.

Another work in the field of pathology is representative of research in the first period. Robert Bunon, dentist of Paris, in two books, published in 1743[21] and 1746,[22] established the conclusion that dystrophy or hypoplasia of the teeth is the result of exanthematous fevers, constitutional disease and other children's diseases, a conclusion which has been repeatedly verified by subsequent work in the present day. Bunon's achievement probably presents the only clinical research of importance in the first period, and is one of the most prodigious single-handed undertakings of all dental history. Having arrived at his hypothesis through many years of practical experience and observation, he set forth only his conclusions in his first work, which he dedicated to M. de la Peyronie, chief of the surgery of the realm, who approved the work on condition that Bunon establish by evidence all the propositions that it contained. Bunon examined between 5,000 and 6,000 patients of the Salpêtriere, young and old, and from these selected 161, who were exhibited in a clinical demonstration before M. de la Peyronie and other distinguished surgeons. In order to answer some objections and to obtain the approval of l'Académie Royale de Chirurgie, he gave a second demonstration presenting the clinical material verbally and furnishing ocular demonstration by dissection of cadaver specimens. Bunon's second work, recounting his clinical study in detail, contained indications of his case histories; and though they would prove quite inadequate in form from our pres-

20. Mitchill, S. L.: Am. J. D. Sc., 1:79-85, 1839, reprinted from N. Y. M. Repository, 1805, vol. 2.

21. Bunon, Robert: Essai sur les maladies des dents, ou l'on propose les moyens de leur procurer une bonne conformation des la plus tendre enfance, & d'en assurer la conservation pendant tout cours de la vie, 1743.

22. Bunon, Robert: Experiences et demonstrations faites à l'Hôpital de la Salpêtriere, & à S. Côme en presence de l'Académie Royale de Chirurgie, pour servir de suite & de preuves a l'Essai sur les maladies des dents, &c, 1746.

ent-day point of view, they foreshadowed the numerous and important statistical studies of a later time based on case histories.

The study of the physical properties of materials employed in dentistry, a subject which, in recent years, has evoked considerable effort in the way of research, had scarcely begun in the early nineteenth century. The only substance which seems to have reached the verge of scientific investigation was porcelain. Most of the metals employed in dentistry were taken over from the jewelers very much as they were used in the trades, and little study was made of them. Porcelain, the only synthetic substitute employed in dentistry, raised the problem of composition with reference to such properties as hardness, fusing point, volume change, solubility in saliva, strength and porosity. Whether the improvements over the crude porcelain of Duchateau, by De Chemant, Dubois Foucou and especially by Fonzi, were accomplished merely by haphazard trial and error, or by something more systematic and worthy of the name of research, it is perhaps impossible to say, as most of the workers (Fonzi in particular) were not anxious to reveal their methods or results, and left no record of their labors. It was probably to elicit a scientific study of the subject that the Société de Medicine de Paris in 1812 offered a medal for the manuscript answering satisfactorily five questions on the application of porcelain to artificial teeth. Dubois Foucou, it was later revealed, had furnished the fund of 300 francs for this prize. Two manuscripts were submitted, one by Maggiolo,[23] prosthetist, of Nancy, and the other by Cornelio,[24] of Turin. Neither work proved to be an entirely satisfactory treatment of the subject.

Research activities in the first period have been developed here considerably at length because (1) it is with this period that the research worker of today is least familiar; (2) the origins of any movement are most important in its history, and (3) it is highly desirable that we should not fall into the error of supposing that research as we know it is the creation of the moment. The chief dental problems of that early period are also the chief problems of today.

From the examples given, several characteristics of the first period should be evident:

1. Although the fields in which dental research was done were restricted, and compared to the countless investigations today, there were relatively few undertaken, these efforts are on the whole commendable and have contributed valuable information.

2. The dental research work of the period is clearly related to the state of development of the sciences of the period. Most of the work is dependent on anatomy, and to a much slighter extent on chemistry.

3. Among the actual methods employed may be distinguished dissection, simple magnification, maceration, chemical reaction, quantitative chemical analysis, measurement, clinical study and rational experimentation.

4. The work is largely that of single investigators without special encouragement. Just as with the investigator today,

23. Not published (see Audibran, Joseph: Traité historique et pratique sur les dents artificielles incorruptibles, 1821, pp. 50-51).

24. Cornelio, Vittorio: Risposta ai cinque questi proposti dalla Società Medica di Parigi intorno alla porcellana considerata siccome opportuna per la confezione dei denti artificiali; in Statistica Odontologica del Piemonte ed in ispecie di Torino per l'anno 1817; 1818, pp. 77-134.

connection with hospitals, schools and learned and professional societies furnished opportunity for study and occasion for publication. Distinctions, approbation, medals and prizes, mostly from learned societies, furnished, in some instances, a reward. The patronage of officials sometimes supported these researches.

The second period of dental research may be regarded as extending from the fourth decade of the nineteenth century to the first decade of the present century. Since during this period research activity attained an ever-widening amplitude and the number of investigators increased many fold, it is hardly possible to exemplify all fields of endeavor. But it will be feasible to indicate some of the respects in which this period shows development over the preceding.

The two most notable characteristics of the period are that it was a period in which the profession of dentistry was becoming acutely sensible of its own existence and of its peculiar problems, and that it was likewise a period marked by the unprecedented development of science in all its departments.

Not only in America were the three principal institutions indicative of a profession accomplished for dentistry by 1840, namely, a dental school, a dental society and a dental journal, but in other principal countries of the world as well, at least the first steps in these directions were about to be taken. In England, the first effort to establish a recognized dental school came in 1841, and the first journal in 1843. In Germany, the dentists of Berlin organized in 1846, and the first German journal of dentistry appeared in the same year. Although an attempt at organization was made in France as early as 1847, most of the development came somewhat later.

At the beginning of this period, too, came the rapid expansion of the sciences already established and the recognition of new sciences. Among the latter should be mentioned histology, physiology, histopathology and bacteriology.

Dental histology has its beginning at the opening of this period. It was not until about 1835 that the compound microscope was perfected to such an extent as to furnish a useful and convenient instrument of investigation. It was immediately turned to the most productive use in dental anatomy, as in the study of other organs of the body. The minute organization of enamel and dentin, tissues known as far back as the sixteenth century anatomists, was studied in detail. At the same time, Retzius,[25] in Sweden, Purkinje,[26] in Prague, and Tomes,[27] in England, almost coincidently, about 1835, discovered the presence of cementum on human teeth, until then known only on the teeth of herbivora. The science of dental histology was developed in the few subsequent years. Sir James Paget, in a report on the chief results obtained in the microscopic study of human anatomy and physiology,[28] published in 1842, declared with regard to the work done on the teeth: "In no organs have the results of recent microscopic researches been so unexpected or so brilliant as in these. They have revealed structures before unknown in each of the three component parts of the teeth." The science of dental anatomy, of which John Tomes constructed the groundwork, was built up during this

25. Retzius, A.: Mikroskopiska undersökningar öfver tändernas särdeles tandbenets struktur, 1836.

26. Fraenkel, Meyer: De penitori dentium humanorum structura observationes, 1835.

27. Tomes, John: Structure of Teeth, Vascularity of Those Organs, and Their Relation to Bone, London M. Gaz., 1:748-755, 1838-1839.

28. Paget, James: Report on Chief Results Obtained by Use of Microscope, in Study of Human Anatomy and Physiology, 1842, p. 21.

period by his British successors, most notably Mummery,[29] and must be accounted the chief British contribution to dental science.

In the development of the study of the minute structures of the teeth, improvements in the preparation of microscopic specimens must not be overlooked. Although thin hard sections and decalcification were apparently employed very early, many refinements have been introduced, such as grinding and freezing. The earliest investigators had no suitable stains, and the development of selective staining technic has done much to solve some of the most difficult problems of microscopic anatomy of the teeth; such, for instance, as the innervation of the dentin.

With the perfection of the microscope, it was possible to study the development of the teeth and ascertain what changes were taking place in the very early stages, to an extent impossible to such earlier investigators as Jourdain. Almost immediately, that is, in 1838, Goodsir made a microscopic study of tooth development,[30] which was far superior to preceding investigations and which was generally accepted at the time. Because of the introduction of artefacts through faulty preparation of specimens, Goodsir's theory contained faulty interpretation. In a series of studies by Magitot,[31] in collaboration with Robin and Legros, the foundation of our modern conception of the embryology of the teeth was laid.

The histopathology of the hard tissues of the teeth was contemporaneous with microscopic study of the normal structure of enamel and dentin, and was in part established by the same investigators. But the investigation of the soft tissues associated with the teeth, except the pulp, was for the most part not undertaken until quite late. The beginnings in Wedl's "Atlas zur Pathologie der Zähne," 1879, were followed by more extensive studies by Black in 1887[32] and Talbot in 1889.[33] Within recent years, the soft tissues have become the principal subject in the histopathologic study of the teeth.

During the first forty years of the nineteenth century, chemistry, under the influence of Berzelius, had become at least temporarily systematized, so that it was possible to apply its principles to problems in other fields. As early as 1799, Charles Hatchett, distinguished British chemist, had made a quantitative analysis of the enamel.[34] This was followed by other analyses of the hard tissues by Josse,[35] Pepys,[36] Morichini, Lassaigne and Berzelius, down to the publication by von Bibra in 1844,[37] of a whole volume devoted to chemical analyses of the teeth and bones of various animals. The chem-

29. Mummery, J. H.: Microscopic and General Anatomy of Teeth, Human and Comparative, Ed. 2, London: Oxford University Press, 1924.

30. Goodsir, John: Origin and Development of Pulps and Sacs of Human Teeth; reprinted from Edinburgh M. & S. J., 1838, No. 138.

31. Magitot, E., and Legros, Charles: Origine et formation du follicule dentaire chez les mammiféres, J. Anat. (Robin), 1873, p. 449ff; Morphologie du follicule dentaire chez les mammiféres, ibid., 1879, p. 248ff; Developpement de l'organe dentaire chez les mammiféres, ibid., 1881, p. 60ff.

32. Black, G. V.: Study of Histological Character of Periosteum and Peridental Membrane, Chicago: W. T. Keener, 1887.

33. Talbot, E. S.: Interstitial Gingivitis or So-Called Pyorrhea Alveolaris, Philadelphia: S. S. White Dental Manufacturing Co., 1889.

34. Hatchett, Charles: Experiments and Observations on Shell and Bone, Phil. Tr. Roy. Soc. London, 89:328, 1799.

35. Josse: Analyse de l'email des dents, Paris, 1802.

36. Fox, Joseph: Natural History of Human Teeth, 1803, p. 92.

37. Von Bibra, Ernst: Chemische Untersuchungen über die Knochen und Zähne des Menschen und der Wirbelthiere, Schweinfurt, 1844, pp. 279, 281.

ical analysis of saliva and of calculus was also frequently undertaken.

There are various indications that chemistry was becoming increasingly interesting to dental investigators. In America, articles on chemical subjects related to oral science and dental materials began, in the forties, to become more numerous. So important was this branch of science in the eyes of the editor of the *American Journal of Dental Science* that a chemist, Dr. A. Snowden Piggot, was appointed to its editorial board of three, in 1853. The same year marks the publication of a work by Piggott, "Chemistry and Metallurgy Applied to the Study and Practice of Dental Surgery." Professors of chemistry were appointed to the faculties of the Ohio College of Dental Surgery in 1846, and the Baltimore College of Dental Surgery in 1849.

The most important early application of chemistry to dental problems in this period was perhaps in the study of caries. Although Robertson, in England, in 1835[38] and Regnart in France in 1828 and 1838,[39] had set forth the chemical hypothesis of caries, neither of them had given any experimental proof. The American, Amos Westcott, in 1843, actually experimented on the effects of various chemical substances on the teeth, and concluded that acids of one sort or another were the cause of tooth decay.[40] The purely chemical study of decay was carried to its highest point experimentally by Magitot in 1867.[41]

38. Robertson, William: Practical Treatise on Diseases of Teeth, in Which Origin and Nature of Decay Are Explained; and Means of Prevention Pointed Out, 1835.

39. Regnart, Louis Nicolas: Recherches sur la carie dentaire, 1838; reprinted from Gaz. d. Hôp. Civ. et Mil. (Lancette Française) 12, February and March, 1838.

40. Westcott, Amos: Dissertation on Dental Caries, Am. J. D. Sc., 4:31-43, 1843.

41. Magitot, E.: Traité de la carie dentaire, 1867.

Bacteriology is almost entirely a development of the second period. As early as 1840, Henle had promulgated the theory of the bacterial cause of disease.[42] Dental scientists were not slow in applying the theory to dental disease. Indeed, Henle himself, as early as 1841,[43] suggested that dental caries had all the indications of being caused by acid-producing micro-organisms. This idea was elaborated with some show of proof by Erdl, in 1843,[44] Ficinus, in 1846,[45] and Klencke in 1850.[46] Leber and Rottenstein, in 1867,[47] made an elaborate study of the relation between micro-organisms and caries, but, probably owing to a lack of staining methods, failed to demonstrate the true relationship. With scant evidence, Milles and Underwood, in 1882,[48] offered the most comprehensive theory embracing both caries and pulp disease, and their hypothesis came very close to that demonstrated in the next few years by the superb experimental work of W. D. Miller.[49] The history of bacteriologic

42. Henle, F. G. J.: Von den Miasmen und Kontagien und von Miasmitish-Kontagiösen Krankheiten, 1840.

43. Henle, F. G. J., Allgemeine Anatomie, Lehre von den Mischungs-und Formbestandtheilen des menschlichen Körpers, 1841, p. 877.

44. Erdl: Allg. Ztschr. Zeit. f. inn. Heilk., 3:159-160, 1843.

45. Ficinus, R., Ueber das Ausfallen der Zähne und des Wesen der Zahncaries, J. f. Chir. u. Augenheilk., 6, No. 1, 1847.

46. Klencke, H.: Die Verderbniss der Zähne, 1850.

47. Leber, T. and Rottenstein, J. B.: Untersuchungen über die Caries der Zähne, 1867.

48. Underwood, A. S. and Milles, W. J.: Investigation into Effects of Organisms upon Teeth and Alveolar Portions of Jaws, J. Brit. D. A., 3:11-18, 1882.

49. Miller, W. D.: Micro-Organisms of Human Mouth—Local and General Diseases Caused by Them, Philadelphia: S. S. White Dental Manufacturing Co., 1890.

research as applied to the etiology of caries illustrates well the dependence of science on the advance of investigative methods for solution of its problems. Miller, who was a pupil of Koch, made use of the latter's lately devised methods of cultivation and isolation and was thus enabled to solve the caries problem more nearly than had any of his predecessors.

To this period belong the beginnings of the study of technical problems of dentistry by research methods. Through the application of chemical and physical methods, some of the materials employed in dentistry were studied. Although modern testing instruments and methods were of later development, some efforts were made by dentists to improve their materials through a study of their physical properties. As early as 1849, Dr. George E. Hawes reported, for a committee of the Society of Dental Surgeons of the State of New York, on the best materials for making dentists' metallic casts to be used as dies.[50] Tests for hardness and expansion were made. It is interesting to compare the hardness testing machine used with the Brinell hardness testing machine of today. A jeweler's drop was employed; a weight was let fall from a known height onto a bullet of the tested material, and the hardness of the metal determined by the extent to which the bullet was flattened.

The study of amalgam by research methods is the outstanding example of the investigation of dental materials during this period. Two chief properties have been studied: physiologic effect and volume change with relation to composition. Increasing refinements in methods of testing, especially in precision measurements, have marked this work from the first early efforts of Hitchcock and Bogue[51] and Tomes,[52] through the remarkable work of G. V. Black[53] to the recent studies of the United States Bureau of Standards.[54] The charge of mercury poisoning early ascribed to dental amalgams was first scientifically tested by Bogue in 1874,[51] and his results have just recently been practically supported by the results obtained by German and American chemists.[55]

During the second period too, the statistical study of dental phenomena developed. Application of statistics to vital facts is a relatively recent development in biologic science. About 1840, Dr. William Farr[56] began to record vital statistics in England, and, only a few years previous, Quetelet[57] presented the first important theoretical work on the subject. Until considerably after the middle of the nineteenth century, statistical treatments in dentistry are rare. It has been gradually realized that such subjects as the incidence of dental disease and the

50. Hawes, G. E.: Metallic Castings, N. Y. D. Recorder, 4:47-49 (Nov.) 1849.

51. Hitchcock, T. B.: Physical Properties of Dental Amalgams, Tr. N. Y. Odontol. Soc., December, 1874. Bogue, E. A.: Physical Properties and Physiological Action of Dental Amalgams, Tr. N. Y. Odontol. Soc., 1875, pp. 43-58.

52. Tomes, C. S.: Chemical and Physical Properties of Amalgams, Tr. Odontol. Soc. Great Britain, 4:135-156, 1872 (2d series).

53. Black, G. V.: Investigation of Physical Characters of Human Teeth in Relation to Their Diseases, and to Practical Dental Operations, together with Physical Characters of Filling Materials, D. Cosmos, 37:553-571, (July), 637-661 (Aug.) 1895.

54. Taylor, N. O., and Paffenbarger, G. C.: Progress Report on Research on Dental Materials (1931), J.A.D.A., 19:405-406 (March) 1932.

55. Souder, Wilmer, and Sweeney, W. T.: Is Mercury Poisonous in Dental Amalgam Restorations? D. Cosmos, 73:1145-1152 (Dec.) 1931.

56. Pearl, Raymond: Introduction to Medical Biometry and Statistics, Philadelphia: W. B. Saunders Co., 1923, pp. 35-39.

57. Footnote 56, p. 35.

establishment of dental norms can best be accomplished in this way. Although statistical studies, largely based on case histories, have increased in number remarkably during the last few years, only the simplest forms of statistics have, for the most part, been employed. The highly mathematical treatment, which has been developed in biology within the last few years, by Karl Pearson[58] and others, under the designation of biometry, has scarcely affected the dental statistician as yet.

Research in dental science during the last twenty-five years is so extensive and so close to our vision that it is hardly possible to present a fair estimate of it. There is one feature of it that stands out, marking a change in the attitude of the profession and the public toward it.

Although the great body of research probably continues to be done by individual students, choosing their own problems and executing their investigations with no special encouragement, there has been an increasing tendency to prosecute research as a social activity. This has been accomplished by a growing emphasis on research, an increasing tendency to make research work paramount in investigation, and to consider it the criterion of progress in the various departments of dental science. This development in the dental field probably has two sources: (1) the tendency to give dentistry a larger and more important rôle in health service; and (2) the tendency in all fields of activity, scientific, commercial and professional, to emphasize research as an instrument of criticism and improvement. It cannot be overlooked that this emphasis has gone so far in dental science, as in every other field, as to constitute, in some measure, an intellectual fad, with the consequent evil of producing research that is frequently only research in form, without much substance. Nevertheless, it must also be recognized that, in dentistry, results may be expected through research in the long run as valuable to dentistry as have been the results in other scientific branches where research is of more mature growth.

As a consequence of this recent attitude toward dental research, various agencies of support and encouragement have arisen. Some of these are within the realm of dentistry and some are without.

First are the organizations of dentists themselves. It is interesting to note that, as far back as 1857, Jonathan Taft proposed to the American Dental Convention that the organization "establish a fund for the promotion of dental science, with special reference to the employment of some competent person or persons, to conduct experiments—physiological, pathological, chemical, and hygienic—as connected with dental science."[59] The debate which followed indicates the inexperience of the profession with scientific methods. The speakers either underestimated the stupendous difficulties met in the investigation of scientific problems, as even Dr. Taft himself seemed to do, or they regarded the measure as unnecessary. One well-known dentist of the time remarked that "if this society had been instituted twenty-five or thirty years ago, then such a course would have been much more consistent and proper, but now the field has been gone over, the science of chemistry has been very fully developed with reference to every branch of art." This attempt came to naught; for although the resolution was adopted, sufficient funds could not be collected, and the project was abandoned.

The most notable effort in America to foster science through dental organizations within recent years has been that of the National Dental Association (now

58. Footnote 56, pp. 41-44.

59. Am. J. D. Sc., 7:535-536 (Oct.) 1857 (2d series).

the American) since 1908, when a permanent committee on scientific research was instituted. Through this committee and the Research Commission, founded in 1913, the Association has either hired or subsidized investigators of special dental problems. In 1916, the Research Institute of the National Dental Association was opened in Cleveland, Ohio, for dental research. In 1920, the institute was given up, and the commission fell back entirely on the plan of subsidizing research workers engaged on dental problems in school or private laboratories throughout the country.

In addition to the research activities of national and local dental societies, organizations devoted exclusively to dental research have come into existence. Foremost among these should be mentioned the International Association for Dental Research, which made its appearance in 1921, with the organization of three branches, one in New York City, one in Boston and one in Chicago. Since then, the local chapters have grown to twenty, six of which are outside the United States, and three in Europe.

Many dental institutions, in the nature of infirmaries or schools, have undertaken to further research work in various ways. Several institutions have been founded with the advancement of research as one of their expressed purposes. Among these are the Thomas W. Evans Museum and Dental Institute (1915), the Forsyth Dental Infirmary for Children (1914) and the Rochester Dental Dispensary (1917). The foremost dental schools have become centers of dental research, partly because the teachers were those best qualified to do research work, and partly because the necessary equipment and opportunity have been provided by schools. The graduate courses, leading to advanced degrees, offered by several dental schools, have done much to direct the interest of the young practitioner into research fields.

Dental journals, from their inception in 1839, have been a strong stimulus to research, as they have made possible the immediate communication of discoveries in the dental field without expense to the investigator. In recent years, there has appeared some tendency on the part of dental journals to specialize in particular branches of dentistry or in particular types of dental publications. With this tendency to specialization, the research worker has found his opportunity in the more favorable reception of research articles by certain journals. The need for a vehicle of expression among research workers in the dental field was fulfilled in 1919 by the establishment, under the direction of William J. Gies, of the *Journal of Dental Research,* closely affiliated with the International Association for Dental Research.

Among the agencies for the furtherance of dental research should be noted the rise of several small groups of investigators, located at certain points of vantage, in large cities or connected with hospitals or with schools. Perhaps more in European countries than in America, such groups have appeared, centering about some distinguished investigator whose pupils or disciples the members of the group are. Most notable of this sort is perhaps the Vienna group of which Dr. Gottlieb is the central figure.

The encouragement of dental research has not come entirely from within the profession, but as dentistry has come to be regarded more and more favorably as a department of health service, agencies outside dentistry have aided in promoting dental research.

Various foundations have devoted funds to dental service, education and research, of which perhaps a small share has fallen to research. Gifts by individuals have also

served to support dental research to some extent, notably the bequest of Thomas W. Evans, and the gift of Mrs. Montgomery Ward to Northwestern University.

Manufacturers of dental supplies have also contributed something to dental research. In many instances, of course, such work as has been done was executed in the manufacturer's laboratories and the methods and results have not been published in full. Nonetheless, manufacturers have considerably supported independent investigation, especially through placing their proprietary formulas and data at the disposal of the research investigator, as seems to have been the case with G. V. Black's elaborate research on amalgam.

Finally, very recently, governmental agencies have devoted their energies to technical problems of dentistry. The work of the United States Bureau of Standards with regard to dental materials, casting technic, etc., is especially worthy of note.

At the close of this sketch of the development of dental research, we may pause to inquire to what good end effort in this direction has been expended. It is perhaps too early to give a full estimate of the benefit derived from dental research, and if the research worker is deserving of commendation and credit, he must still be prepared to face certain rather discouraging facts. As has already been said, most of the principal problems of modern dental research are those which dental science and dentistry, with scant research, was endeavoring to solve 100 years ago. If caries of the teeth, pulp disease and pericementitis may be regarded as the three great problems of dentistry, it must be admitted that none of their etiologic, pathologic and therapeutic problems has been solved completely. No doubt most has been accomplished with regard to caries, and much valuable information has been acquired through research with regard to all three conditions; but dental research seems to have accomplished little toward solving the essential problems associated with pyorrhea and pulp disease.

On the other hand, dental research has been more fortunate in other directions. It is among the notable achievements of the last quarter century that one pathologic condition of the teeth was discovered, analyzed histologically and traced to its cause with certainty (if we are not judging too hastily) within that period. I refer, of course, to mottling of the enamel, and the recent determination of the presence of fluorides in drinking water as its cause.[60]

60. McKay, F. S.: Fluorin Content of Certain Waters in Relation to Production of Mottled Enamel, J.A.D.A., 19:1715-1725 (Oct.) 1932.

A COMPREHENSIVE VIEWPOINT FOR PROFESSIONAL TRAINING*

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IT has never been my good fortune to live where I could associate with dental college work. Early in my career, I was appointed to the board of dental examiners, and was able in that work to have a box office viewpoint of the work of the colleges of this country. Like the old maid who can always tell a mother's club how to rear children, I have had some ideas and convictions regarding the subject of training men for the professions. No one ever took my ideas seriously, and this is my first chance to make a group of dental deans listen to my viewpoint. That is not the exact truth, for as far back at 1910 in Denver, J. G. Sharp read a fine paper on "The Obstacles to Our Educational Progress, and Their Correction," and many of his remarks were severely criticized by prominent deans of that day. I was, as I recall, his only defender. Dental colleges with their methods and systems have made remarkable progress since Jim Sharp's call to arms at the Denver meeting. The things he pointed out and complained of have nearly all been worked out and eliminated through the cooperation of the American Association of Dental Schools with the Dental Educational Council.

In spite of this advancement, we are today as far from agreeing on some important basic issues as in 1910. I have read the proceedings of one of the recent meetings of the American Association of Dental Schools. I am sorry that I did not count the number of references in the papers and discussion to the subject of elevating dentistry to the level of medical science. I would also like to have a tabulation of the references pertaining to the possibility of making dental and medical training joint courses.

There were five papers on engineering subjects pertaining to dental education; that is, the mechanical side of dentistry. There were six papers on various phases of teaching—therapeutics and materia medica—five papers on technical angles of dental educational policies and three on laboratory technic, with one each on economics and the "Responsibility of Dental Schools for Success of Graduates," a subject which seems to be a stranger in the line up.

I hope that I will not be misunderstood in mentioning this subject. It is not my object to find fault, but to lay the foundation for my ideas on professional training.

It is quite proper that discussions of engineering problems in dental training should be frequent, for the success of all dental life and practice is dependent on mechanical aptitude and skill. Here is ground for one of my viewpoints, which is that not enough consideration is given to ascertaining why Mr. A. B. desires to study dentistry. More investigation should be made to ascertain whether the candidate for registration possesses the qualifications for absorbing dental train-

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ing and developing mental skill. Investigation should determine whether the candidate desires to emulate the example of some highly successful dentist without possessing any of the natural qualifications to realize that ambition. In fact, I make a plea for more predental appraisal of fitness before allowing students to matriculate. I have been privileged to recommend many boys to different dental colleges throughout the country, but I have never done so until I have assured myself on this question; and I have never yet had a college "check back" to learn on what I based my willingness to sponsor the boy. We should try to protect the prospective student and save him from selecting unwisely his life work. There is so little difference between success and failure in life.

Again, I would appeal for more thorough investigation of character. Every operation in the daily practice of a normal dentist is made a success or a failure by the degree of conscientious integrity the operator applies to his efforts. The root-canal debacle of the past fifteen years would never have been so destructive if a higher degree of character had been manifested in the efforts of operators. If a student is allowed to matriculate on faulty qualifications, pass his examinations by cheating and complete his laboratory requirements by bribing the drudge, or by some other subterfuge, you can be sure that the trusting patient who chances to fall for his charming manners and smooth talk will find the same degree of cheating in cavity preparation or in establishing of contact points in practice. The roentgen rays and the little dental film have united to hold up to ridicule the caliber of manhood which inspired many an operator. So I make a plea for more inspirational training and character building in professional education. Faculty example and precept are more effective in molding student character than is the subject the faculty member teaches. The susceptibility of the mind of the student to the influence of personal character or habits of their teachers and leaders makes it unwise, in my opinion, to retain a faculty member whose personal habits are not clean and whose character will not stand investigation. It is not enough to teach a given subject efficiently, if it is done at the expense of the character of the student life. Our instructors, through their influence, by force of character and example, should impregnate the student with the will to do, the determination to succeed. Make them realize that most people know too much and use too little of what they know.

It is my belief that there is not enough personal contact between college administration officials and the individual student. The personal relation is lacking in intimate appraisal of possibilities for success or failure. Some system should be developed in every college for careful, sympathetic understanding and appraising of the individual possibilities for success of each student. The young man starts in to study dentistry, but is he capable of becoming a success, or is he doomed to failure? Our profession is being attacked constantly by members from within who should have been encouraged to find other vocations in life after their freshman year. They might have brought credit and even honor to a calling that they were fitted for, in place of failure or near failure in a profession which they were never intended for by nature. These are the big responsibilities resting upon our colleges today.

While serving on the board of regents of our state university, this question assumed to me a very important aspect. I was greatly interested in the change which developed in the junior division

and set up entirely different procedures for personal contact with the Freshman. State universities are demonstrating the need for more intimate, sympathetic, inspirational contact with these untrained youth, who are often away from home influence for the first time. How many lives could have been saved from ruin by a greater degree of freshman supervision for the untried feet! How often the closer contact would have brought out and demonstrated the error of judgment which led to the selection of some particular course. It is important to instruct students, but more important to inspire them, and a closer relationship with freshmen makes for greater opportunity to inspire them.

While I do not wish to seem critical, I do desire to make a suggestion to certain of our colleges. Dentistry was conceived into a field of mechanical restoratives. To replace in whole or part the masticating machinery of the human being was a very important portion of this early dental service to humanity. In the past, it has been, as it should be, a recognized accredited service, laudable and dignified. During recent years, with inflated prosperity prevailing, a false attitude has crept into our dental educational system and in at least some of our colleges, the art of making restorations has been unduly depreciated—in some cases, to such an extent that new graduates feel that this work is beneath their dignity, and, as a result, they enter the dental field poorly equipped for this work. They fail to install laboratory equipment to carry on this very important branch of their profession. Too many young dentists become slaves to the commercial laboratories and depreciate the importance of making themselves proficient in prosthetic technic. This is, I feel, a menace to the future of our profession. Our colleges should endeavor to enhance the dignity, to emphasize the importance of the art of prosthesis. Our colleges should adequately train all graduates to enter their professional career with a spirit of confidence in their own ability to master each and every division of dental science. Their training should not lead them to depreciate the importance of the art of fabricating and constructing artificial dentures, which their service to the public may require. I make a plea for a rebirth of conscientious training of all undergraduates in the art of laboratory technic.

The chief directing influence for meeting these challenges are our new deans, Drs. Lischer and Purcell, and all other dental deans. Their records for mastering of important issues and their reputations in professional life, community activities and church and cultural connections have pointed them out to the governing boards of these two colleges as eminently fitted to measure up admirably to the requirements of present-day needs. In closing, I submit my case to their good judgment and discretion. It is given to them to guard the portals of our profession. Through the men that they inspire and train, the glories of our profession must be transmitted unimpaired to future generations. In proportion as these splendid men attain their ideals and ambitions will the safety of our honored record remain, for nobler achievements and greater service to the health and happiness of mankind. In proportion as we equip ourselves to render efficient health-giving service to our fellowmen and thus put an end to suffering and pain, will we have merited the trust imposed in us.

FUNCTIONAL FACTORS IN THE SELECTION AND ARRANGEMENT OF ARTIFICIAL TEETH*

By BERT L. HOOPER, D.D.S., Lincoln, Nebr.

TO create with his own hands works which closely simulate nature has been the aspiration of man down through the ages. The sculptor satisfies his desire by hewing in some material the forms of man or beast. The painter with his brushes and colors is able to present on canvas most accurate likenesses of living or inanimate objects. Other allied arts give man an opportunity to disclose his knowledge and ability; and, while enjoying the task of producing a work of art, he also affords pleasure to those who love and appreciate such achievements.

Dentistry, and particularly prosthetic dentistry, offers opportunity to express one's creative ability to the highest degree. The dentist is called on not only to imitate nature in form and color, but also to produce a work which will actually deceive the eye of the observer, even when placed, as it must be, in direct contact and comparison with living tissue. The dentist must go a step farther: that which he produces must not only appear natural, but also function as a normal living organ of the human body; which involves a great responsibility.

This responsibility necessitates a keen perception and a fine interpretation of a multiplicity of conditions which govern or affect the efficiency of artificial dentures.

The dental profession in the past has been too prone to disregard many of these conditions, or to place too much consideration on one or two and give too little attention to others. For instance, esthetics and the functional requirements that should be associated with mastication and phonation are often disassociated. Esthetics, as applied to the construction of dentures, has been so vague and intangible that consideration of it has been avoided to a great extent. Other functional requirements, being more readily perceived and grasped, as well as more easily met, have received more attention.

Today, the profession is developing a more equalized valuation of the requirements and the numerous factors involved, the result being better dentists, better dentures, better patients.

In this discussion of the functional factors in the the selection and arrangement of artificial teeth, we will consider all factors as being inseparable, because a case cannot be considered efficient in its entirety until all requirements are fulfilled.

In order to become proficient in selecting and arranging artificial teeth to satisfy Nature's requirements, the dentist must school himself by observation of natural teeth, and he must become skilled in the use of instruments and materials to produce as nearly as possible exact likenesses of what is seen in nature.

There is a tendency for many of the profession to ignore Nature's design; but

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doesn't it seem plausible that artificial teeth of the same size and shape and set in the same alinement in the mouth as the natural teeth will function more efficiently and more comfortably than any other selection of teeth? The lips, cheeks, tongue and masticatory mechanism are so developed that, in functional activity, there is muscular pressure on both sides of the teeth which is uniform and balanced. When artificial teeth of the size and shape of natural teeth are placed in the mouth in the same position that the natural teeth had, this equalized muscular pressure stabilizes the dentures.

Figure 1 shows the natural tooth in its bony support and the relation of the cheeks and tongue.

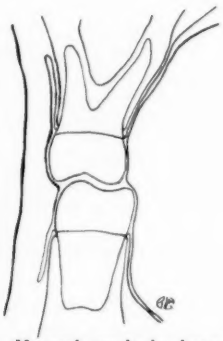

Fig. 1.—Natural tooth in bony support; showing relation to cheeks and tongue.

Figure 2 shows the same area after extraction of the tooth. As the tissues heal, the crest of the ridge shifts lingually. (Fig. 3.)

The overpressure of the tongue against the denture, if the teeth are set over the ridge, cannot but interfere with speech and tend continually to dislodge the denture; and there is no support from the buccal side to counterbalance the overpressure. (Fig. 4.)

It is also obvious that if the artificial teeth are arranged to make possible the established habitual movements and functions of the jaws and teeth, that function may continue unaltered; or to the degree that changes are made, habits related to functions of the mouth and correlated parts must be changed. A selection and arrangement of teeth which alter habitual functional activities are especially undesirable for the older patient, whose adaptability to new conditions is less favorable. As younger patients adapt themselves more readily to change, if extreme irregularity of the natural teeth is present, or if disease has created conditions which it is inadvisable to imitate in the artificial teeth, the selection and arrangement of the artificial teeth may safely vary somewhat from the natural.

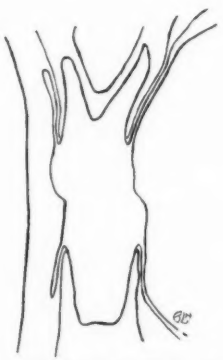

Fig. 2.—Area shown in Figure 1; after extraction of tooth.

In most cases, in young or old, it is best to follow accurately the mold, hue and alinement of the natural teeth. In order to do this, adequate preextraction records are a prerequisite. These consist of the mounted natural teeth and a series of photographs. (Figs. 5-7.) Impressions of the natural teeth taken before extraction permit them to be mounted in their original relation to each other, so that the

individual teeth may be studied; also their relation to the adjacent teeth in the same arch and the relation of opposing teeth, individually and collectively.

By means of the photographic record, it becomes possible to restore exact facial dimensions and to develop natural facial characteristics and retain them through the years.

When adequate preextraction records are available, the selection of porcelain teeth and their orientation in the oral cavity may be very definitely determined by means of measurements, comparison and reference to the mounted natural teeth and the photographic record. A study of a number of such records and constant observation of natural mouth conditions make one more appreciative of the factors and the functional requirements involved in denture construction, and give the most tangible assistance in selecting and arranging teeth for edentulous cases that we have to aid us. (Figs. 5-7.)

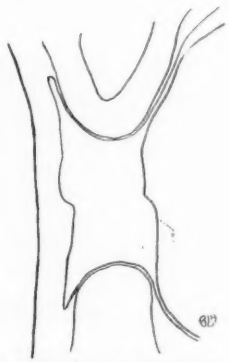

Fig. 3.—Shift of crest of ridge lingually as tissues heal.

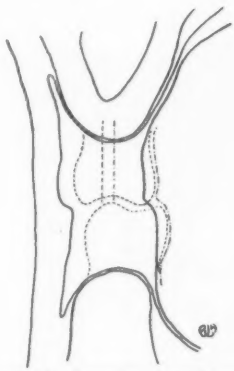

Fig. 4.—Lack of support from buccal side to counterbalance overpressure of tongue against denture which interferes with speech and tends to dislodge denture.

There are five points to be considered in the selection of anterior teeth for an edentulous patient: (1) shape or mold; (2) size; (3) color or hue; (4) length of the bite of the tooth, and (5) thickness of the incisal third. (Fig. 8.)

The mold of the tooth required is indicated by the general shape of the face, as to whether it tends toward one of the three basic forms, square, tapering or ovoid. If the face is typically square, tapering or ovoid, a typically square, tapering or ovoid tooth is selected. As most of our cases present modified face forms, care in selecting teeth of harmonizing modified form should be exercised.

The second factor for consideration is size. Here, we have three things to note: (1) the size of the mouth when relaxed and at rest, as well as when in action; (2) the size of the face, and (3) the size of the patient. (Fig. 9.)

The width of the six anterior teeth may be found by passing a pointed instrument between the lips at their distal extremities, marking the position on the bite rims. The instrument must have its long axis at right angles to the general surface of the adjacent tissue when this record is made, and the lips must be

relaxed. The functional range of the lips when the patient talks, smiles and laughs must be observed. The greater the functional range, the greater the importance attached to the selection of a tooth of a size to occupy the proper amount of space in the mouth.

With the modern pink base materials now available, it is unnecessary to select extremely long teeth in order to position the base material far enough under the lip to hide it from view. In fact, our work may be the more deceptive, and may be enhanced, if a slight amount of properly carved modern pink base shows.

The size of the face should determine the size of the teeth, in order that a satisfactory esthetic balance may be attained; and for a like reason, the size of the patient is a factor.

If the patient has a large body, face and mouth, the teeth should be proportionately large. Sometimes, the patient has a large body and face, but a comparatively small mouth. In this instance, the teeth selected should be as large as possible for harmony, but must not impair phonation and mastication.

Other combinations might be sighted which would affect the selection of teeth. In all such combinations, judgment plays an important part in the decision; and judgment can be cultivated only by continued observation.

It must be borne in mind that teeth must be of such size as to support the tissues and muscles, in order to promote proper mastication, phonation, harmony and normal movements in facial expression.

The factor of color is important only from the esthetic standpoint. Often, the color is a decided factor in determining whether a patient will wear dentures, regardless of how satisfactory the functions of mastication and phonation may be. The important thing to keep in mind in deciding on color is harmony. The color of the porcelain teeth will be governed mostly by the color of the skin. While perhaps all colors may be found in the skin, the predominating color is yellow. The color of next predominance is red.

Color, modified by the addition of white or colorless matter, produces tints of lighter value; and by this process, lightness of the complexion is produced. By the addition of black, or a combination of black and white, or gray, complexions become darker or shaded.

What is true of the skin is true of the teeth: Yellow predominates in natural teeth and the manufacturer has produced like colorings in the porcelain substitutes. Lighter hues of porcelain are those tints produced by dilution of yellow. Darker hues of porcelain are those shades produced by addition of some degree of gray.

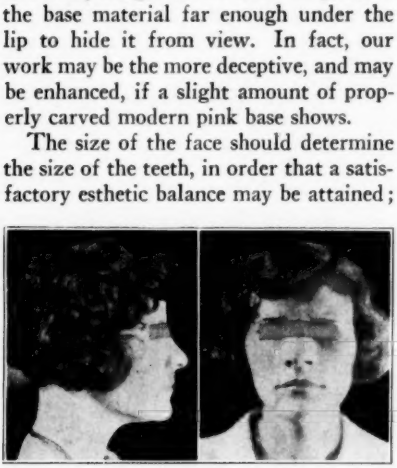

Fig. 5.—Photographs taken as preextraction record.

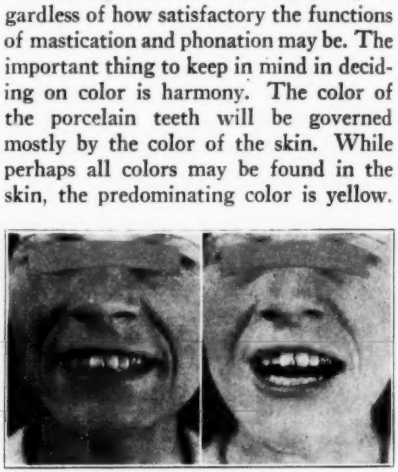

Fig. 6.—Photographs taken as preextraction record.

As we observe the various tints, colors and shades based on yellow, as seen in complexions, we are able to associate with these variations the different tints, colors and shades of porcelain teeth.

If the patient falls in the classification as of light complexion, the choice of porcelain falls more nearly in the comparative color as produced by the manufacturer. If the color of the skin tends toward a red, a tooth of the same color value will be selected. As the skin becomes dulled with gray pigment, the choice of porcelain will fall in those shades which give the teeth a duller or less conspicuous effect. Of course the producers of teeth have widened the selec-

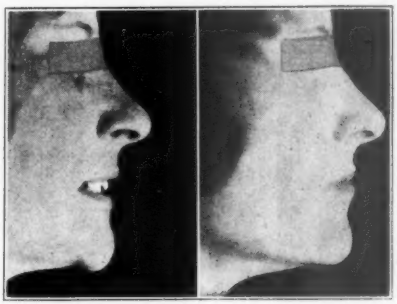

Fig. 7.—Photographs taken as preextraction record.

tion of colors by the addition of pink and blue and those hues which tend to brown and green. The last mentioned is rarely indicated.

Having selected the color on a basis of yellow, its tints and shades, we may then decide whether a slight variation toward other coloring might add to the esthetic value. The addition of pink to a gray porcelain incisal edge gives the appearance of translucency, which is often highly desirable, especially in younger patients.

These statements are not intended to preclude the fact that the incisal edges of some teeth are free from yellow pigment. Our color decisions must be made on what we see when the patient smiles, when usually a part or all of the yellow at the gingival aspect is disclosed. While the incisal edge may be free from color pigments, the fact remains that the effect is materially altered by the contingency of the yellow gingival area. If, when the patient is talking or smiling, the observer's eye is not constantly attracted to the teeth, a state of harmony may be said to exist and the color is satisfactory.

The length of the bite of the individual

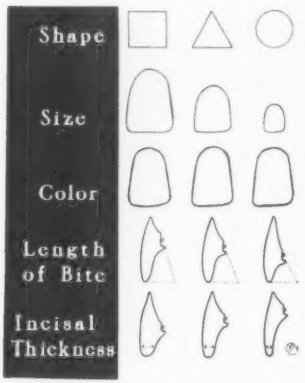

Fig. 8.—Five points to be considered in selection of anterior teeth for edentulous patient.

tooth is an important factor from the standpoint of mastication and enunciation. The tooth with a long bite is more efficient in the function of incising, as the edge is thinner and sharper, and the long bite makes a more efficient wedge in separating a morsel of food from the main piece. The tongue has a more desirable contour to work against when a long bite tooth can be used, and less impediment in speech results.

If a selected mold for a given case has a very short bite and a thick incisal third,

it is good judgment to yield in the selection to a modified mold with a long bite, especially if the decision be between efficiency of mastication and phonation as against esthetic values. If a change in mold is made for the long bite tooth, the mold selected may usually be altered sufficiently by grinding and reshaping to satisfy the esthetic requirements.

The fifth factor is important owing to its effect on cutting efficiency, and the fact that a minimum of bulk is placed in the area where enunciation becomes a consideration. The limit of thinness is governed by the danger of fracture.

In the selection of posterior teeth, there

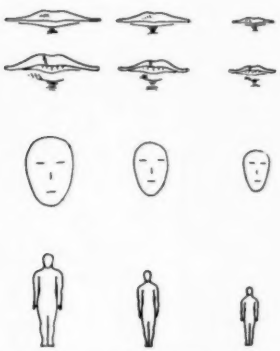

Fig. 9.—Diagram illustrating factor of size in selection of anterior teeth. Size of mouth and face and size of patient are to be considered.

are four factors to be considered: (1) color; (2) mesiodistal and buccolingual dimension; (3) occlusogingival dimension, and (4) the general contour of the occlusal surface. (Fig. 10.)

The color of the posterior teeth, of course, must harmonize and correspond with that of the anterior teeth. If the ridges are of sufficient length and breadth and of suitable form, the posterior teeth should be proportionate in size, even when large anterior molds are selected. If the dimensions of the ridges are limited, it will be necessary to select a relatively smaller posterior tooth. If the ridge form is such that the pressure must fall on sharp, narrow surfaces, or is irregular, which predetermines a limited amount of pressure, the posterior teeth should be relatively small, thus minimizing the occlusal area and stress. In this connection, a consideration of occlusal contour and cusp height is an important item. It is of utmost importance that, in deciding on posterior teeth, the preservation of the ridges, the foundation upon which our work depends, be given prime consideration.

It is obvious that factors in the selec-

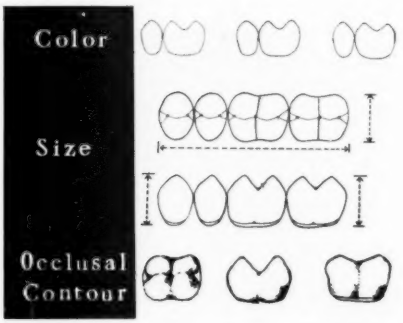

Fig. 10.—Factors in selection of posterior teeth.

tion of teeth are equally pertinent to their arrangement. The subject of arrangement will be dealt with more or less independently. The first factor to be considered under arrangement of teeth is the space which the teeth and dentures as a whole will occupy. In this factor, there are four items to be taken into account: (1) the vertical relation of the mandible to the maxilla; (2) the anteroposterior dimension; (3) the lateral dimensions, and (4) centric relation.

If the patient has lost the natural teeth within a six months' period, the bite

rims should be built to a height which will permit the vermilion border of the lips to fall together in a definite contact when the lips are relaxed, in order to establish the vertical dimension. (Fig. 11.) If there is visible evidence that the vertical dimension has been diminished by resorption of the ridges, the bite rims should be built to a height which will allow the vermilion borders to come together with but light contact when the lips are relaxed. If the case is one in which considerable alteration in the vertical dimension has occurred, the bite rims should be built to a height which will hold the vermilion border of the lips slightly apart, but not far enough but that, with a slight effort, the patient can bring the lips together.

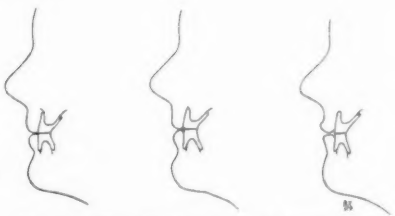

Fig. 11.—Establishing vertical dimension.

It is obvious that while we are obtaining the correct length of the lips, we are also locating the vertical position of the occlusal plane. (Fig. 12.) It has been observed that, in a large percentage of cases, the tip of the buccal cusp of the upper first bicuspid falls on the normal rest lip line.

The following characteristics in facial expression evidence a diminished vertical dimension:

The contacting surfaces of the vermilion border of the lips are flattened. (Fig. 13*A*.)

The junction of the vermilion border of the upper lip with the skin becomes protruded. (Fig. 13*B*.)

A horizontal wrinkle or fold develops in the upper lip. (Fig. 13*C*.)

The lower lip at the vermilion border folds back slightly under the upper lip. (Fig. 13*D*.)

A fold or wrinkle develops between the vermilion border of the lower lip and the chin. (Fig. 13*E*.)

The lips have the general appearance of being pressed together. (Fig. 13*F*.)

Cupid's bow is straightened out, and in extreme cases, it is almost obliterated. (Fig. 13*G*.)

The chin appears pointed and protruded. (Fig. 13*H*.)

Pouches make their appearance. (Fig. 13*I*.)

Muscles become prominent and furrows develop between the muscles of the neck. (Fig. 14.)

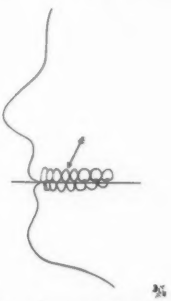

Fig. 12.—Locating vertical position of occlusal plane.

The lower third of the face is out of proportion to the remainder of the face. (Fig. 15.)

Even the ala of the nose is sometimes forced upward. (Fig. 16.) Recession of the ridges allows the flanges to change the position of the ala and, in turn, the general shape of the nose. (Fig. 17.)

The anteroposterior dimension of the denture space is determined by the position that the lips are to assume. If photographs or snapshots of the patient may

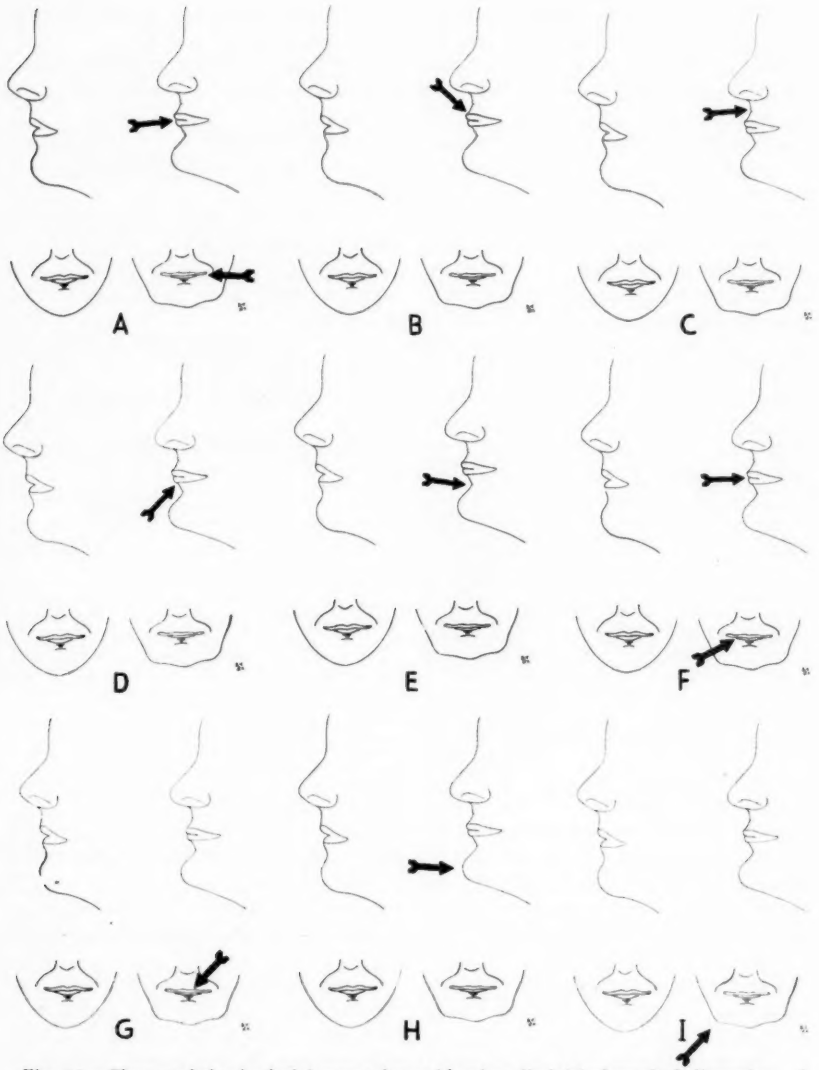

Fig. 13.—Characteristics in facial expression evidencing diminished vertical dimension. *A*, flattening of contacting surfaces of vermilion border of lips. *B*, protrusion of junction of vermilion border of upper lip with skin. *C*, development of wrinkle or fold in upper lip. *D*, folding back under upper lip of lower lip at vermilion border. *E*, development of fold or wrinkle between vermilion border of lower lip and chin. *F*, general appearance of lips being pressed together. *G*, straightening out or obliteration of Cupid's bow. *H*, pointed and protruded appearance of chin. *I*, appearance of pouches.

be had, they may offer great assistance in determining the facial profile. They will also aid in determining the vertical dimension, and the position of the lips.

Friends or relatives or the patient himself may offer suggestions in this matter. Otherwise, the task is thrown entirely on the judgment of the dentist. The only course to pursue is to increase or reduce the anterior surface of the bite rims until the lips, when not in action, assume a relaxed or reposed effect. If the bite rims are built too far forward, a fullness or stuffed appearance will be evident, and the patient will have a tendency to work the lips over the bite rims. If the surface of the bite rims is located too far back over the ridge, the lips and cheeks will appear lax and torpid.

Fig. 14.—Prominence of muscles and development of furrows between muscles of neck in presence of diminished vertical dimension.

The lateral dimensions of the denture space is based (1) on the position of the ridges within the space, and (2) on the support required by the lips, cheeks and tongue.

In the first requirement, it is important that a relationship be established between the bite rims or teeth and the ridge that will favor stability. When a patient has been edentulous for some time or has been wearing ill-fitting dentures, the tissues surrounding the oral cavity, as well as the oral cavity, undergo certain changes in shape to conform to whatever condition exists in the space normally occupied by the teeth. These changes set up a different muscular pressure or contact about artificial dentures in comparison to the contact which Nature placed about the natural teeth.

Therefore, a different mechanical condition presents itself as far as stability of dentures is concerned, in the edentulous case with changed muscular positions and tension, than when the natural teeth were in position. For this reason, we must adopt a procedure in the arrangement of teeth which will conform to the condition presented. While it is possible to disregard more or less the position relative to the ridges, in imitating the position of the natural teeth after recent extractions, it is better in edentulous cases to place the teeth over the ridges to conform to the laws of leverage and stability and allow the cheeks, tongue and lips to conform to the new arrangement of teeth. The stability offered by placing the teeth over the ridge will compensate to some degree for the unequal pressure which, in all

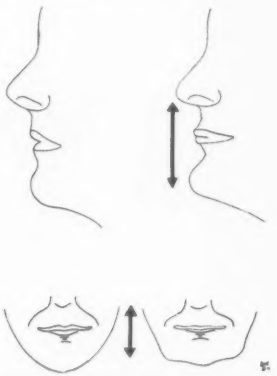

Fig. 15.—Diagram showing lower third of face out of proportion to remainder of face in presence of diminished vertical dimension.

probability, exists between the denture and the tongue, cheeks and lips.

The shape of the face and the support required by the lips and cheeks to develop a satisfactory facial expression or appearance will determine the type of arch form that the bite rims are to assume. This form will also be affected by the amount of space required by the tongue for proper functional movements in phonation and food control. If the arch form of the ridges is the same general form as that of the face, either square, tapering or ovoid, the arrangement of the teeth is a simple matter, because they too will follow the same form and may be placed over the ridges to insure stability.

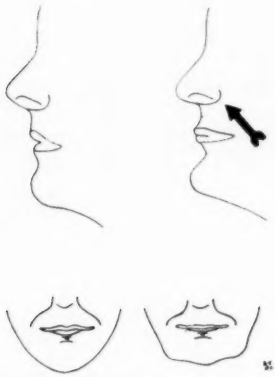

Fig. 16.—Diagram showing ala of nose forced upward in presence of diminished vertical dimension.

We are confronted at times with cases in which the ridge form does not follow the type of face form. In these cases, the dentist must determine for himself how far he can digress from placing the teeth over the ridge for stability in order to satisfy the esthetic demands related to arch form.

Centric relation is the last factor in the size and form of the space which the artificial dentures are to occupy. The foregoing dimensions having been obtained, the use of an accurate instrument to produce a gothic arch tracing is perhaps the most dependable method for obtaining centric relation. The use of such an instrument is generally understood, and further explanation here is deemed unnecessary. When the gothic arch tracing with the mandible in an unstrained retruded position is obtained, the space which the teeth or completed dentures will occupy is determined. The completed bite rims will also carry markings indicating the median line and the angles of the mouth, as well as checkbites for setting the instrument on which the teeth will be arranged.

Fig. 17.—Recession of ridges allowing flanges to change position of ala and, in turn, general shape of nose.

The next general factor to consider is the exact position that the teeth are to assume in the denture space.

Although the bite rims have been shaped as accurately as possible, they can be considered only as approximate. Owing to the fact that the bite rims are bulky and the patient is keenly conscious of their pressure, the muscles acting over them do not perform normally; and not until the teeth have been arranged on the trial bases for inspection can the exact

position of the teeth in the denture space be determined.

There are seven things to consider in determining the position of the artificial teeth in the oral space: (1) the vertical position of the occlusal plane; (2) the anteroposterior position; (3) their position as related to the median line; (4) the lateral dimensions of the arch; (5) the arch form; (6) the position of individual teeth in relation to the adjacent teeth, and (7) the position of opposing teeth, individually and collectively, looking toward occlusal and masticatory balance.

As has been stated, the approximate position of the teeth has been determined in the bite rims; therefore, with the case mounted on an instrument, we follow the bite rims as a guide in arranging the teeth. The first five items are the easiest to execute; the sixth item calls on one's creative and artistic ability, and it is here that much may be accomplished to deceive the observer into believing that the dentures which we create are the ones that Nature bestowed.

If the patient is large, possessing a large face and mouth, the irregularity will probably not be pronounced, owing to the fact that the full width of the teeth must be taken advantage of, to care for the mesiodistal dimension of the entire arch. If the mesiodistal dimension of the ridge or arch is short in comparison to the size of the face and the patient, it is advisable to select a tooth as nearly in proportion to the face as possible, and to incorporate a greater degree of irregularity.

There are certain types of irregularity in the alinement of teeth that follow the particular form or shape of the tooth. For instance, the irregularity in alinement of a typical square type tooth will be characteristically different from that of the ovoid tooth. As a certain type tooth form is modified toward another form, the irregularity characteristic of the two types may be incorporated to the extent that one type or form predominates over the other.

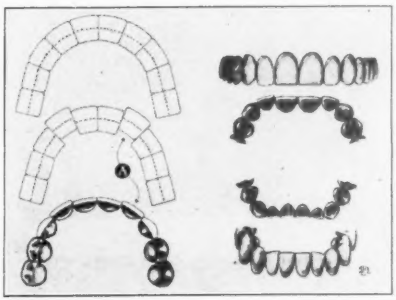

Fig. 18.—Positioning of square teeth.

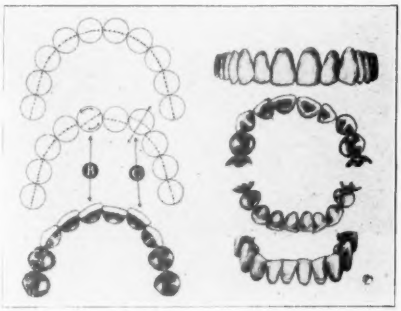

Fig. 19.—Positioning of ovoid teeth.

Owing to the more flattened surfaces of the typical square tooth, there are less apt to be rotated teeth of this type; and, in general, we should be rather conservative in incorporating irregularities in artificial teeth of the square type. If there are any teeth out of perfect alinement, they are more apt to be moved labially, with no rotation. (Fig. 18.)

The patient requiring an ovoid tooth will usually exhibit more pronounced irregularities. Owing to the rounded surfaces of the ovoid tooth, it is more apt

to slip from normal contact with the adjacent tooth, and to assume an abnormal rotated position. (Fig. 19.)

The tapering tooth also is subject to rotation from its normal alinement, overlapping of anterior teeth resulting, owing to the rather acute mesio-incisal and disto-incisal angles; or the incisal edge may be moved labially or lingually from normal alinement. (Fig. 20.)

The foregoing ideas are rather basic as regards the three typal forms of teeth and only suggest a start in the arrangement of irregular teeth. The combinations and possibilities in arranging teeth are unlimited. It is only necessary to apply the laws which govern or influence

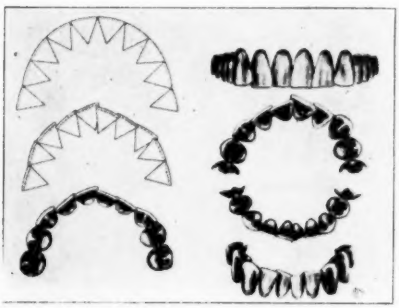

Fig. 20.—Positioning of tapering teeth.

irregularity in natural teeth in order to produce an effect which will be appropriate and harmonious to the particular case.

The seventh factor regards the relation of opposing teeth and affects all the functions in and about the oral cavity.

The first function in the edentulous case to receive consideration is the mechanical requirement, affecting the preparation of food for deglutition and assimilation.

Extreme overbite and overjet of the anterior teeth should be avoided, unless the case has been edentulous for a short period of time, and a knowledge of the amount of abnormality is available. Edentulous cases of long standing should possess overbites and overjets which promote balance under stress.

There is no harm in establishing well-balanced occlusal contact in centric relation and a condition in which a balanced contact is maintained between both dentures during the masticatory excursions. Occlusal forms, cusp height and facets at angles to promote such balance are desirable.

Volumes have been written pertaining to this phase of denture construction, and rather than confuse the reader with another version of this branch of full denture prosthesis, I shall leave him to his

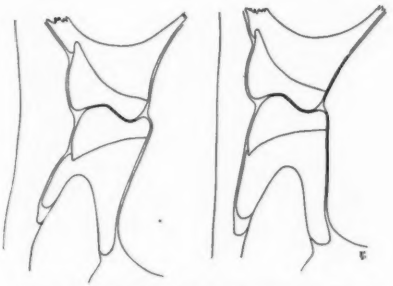

Fig. 21.—Position of posterior teeth lingually from ridge and over tongue (left), which may be taken in process of conversation; a condition which should be corrected so that tongue may be elevated without interference (right).

own conception of this mechanical problem, with the hope that ideas herewith expressed will give an impetus toward bettering his general technic.

Overjet and overbite are factors to consider in phonation; and should the patient's ability to enunciate be impaired, it will be time well spent to rearrange the teeth in regard to the two mentioned positions, always keeping in mind masticatory requirements as well as esthetic demands.

When the teeth have been tentatively arranged, a trial is made in the mouth for observation. Never come to conclusions in regard to the appearance and effect of the artificial teeth on facial expression until the patient has become relaxed and accustomed to the trial dentures. As soon as there are indications of relaxation about the mouth, engage him in some form of conversation. Ask him to count from fifty-five to sixty. His thoughts being diverted to his counting, a more or less normal muscular movement of the mouth may be observed.

If the lower lip strikes the upper anterior teeth at a reasonably near normal position for the particular case, the enunciation will be clear; otherwise, the teeth should be moved to effect better enunciation.

Ask the patient to pronounce other words which may come to mind, especially words containing the s sound. If a whistling sound is produced, the position of the anterior teeth should be altered until the correction is accomplished. Various positions may be tried; there is no fast rule.

Ask the patient to say "some chicken." This embodies the s sound and also brings a smile, which allows for observation of details, such as the color of the teeth and whether it is in harmony with the general facial coloring; the tooth form and whether it supports the cheeks and lips and gives the correct perspective and tooth value; the occlusal plane and whether the proper proportion of upper and lower teeth are noticeable, and the alinement, and whether it seems too regular to harmonize with the facial characteristics.

By means of the process of elimination, corrections should be made until the results are harmonious and satisfactory.

Sometimes, after a careful arrangement has been made, a state of perfection is in evidence which is not in harmony with the patient's appearance. This may be changed by the addition of perhaps two or three well-placed and well-designed gold fillings, or by staining the teeth to break the perfect coloring of the porcelain teeth.

If, during the process of conversation, the lower denture rises from the ridge, an inspection should be made concerning the position of the posterior teeth over the ridge. The posterior teeth should not lie lingually from the ridge, so as to lie over the tongue (Fig. 21, left), and if such condition exists, it should be corrected so that the tongue may be elevated without interference, as in Figure 21, right.

Teeth should be arranged on a very stable base for the trial procedures. A metal base cast of low fusing metal is recommended for the trial base, in conjunction with a wax which remains rigid at mouth temperatures.

It is well to use an adhesive powder during the trial procedures to free the patient of apprehension as to possible dislodgment of the dentures.

Ample time should be taken in the trial procedures to obtain satisfactory results. It is never advisable to work for a long period of time. From one-half to one hour is perhaps all the time that should be spent at one sitting, since one loses his keenness of observation over the long period of examination. If necessary, it is best to make a second and a third appointment to complete the trial procedures and corrections.

Selecting and arranging teeth to satisfy functional requirements is an interesting and fascinating work. Our knowledge of the normal natural teeth and of abnormalities that occur in nature opens avenues of intense interest. Our knowledge, skill and willingness to work are the only limitations.

INFLUENCE OF THE SUN ON THE TEETH*

By LILLIAN LINDSAY, L.D.S., London, England

A WRITER has said, "The history of the world, is it not the history of the sun?" This applies particularly to the early history of the teeth; for early man, seeking to express his most potent desires and needs, found outward and visible signs in the objects which seemed to embody these, whether from some intrinsic property in them based upon analogies which, to his primitive mind, appeared to be true, or from some fancied resemblance to a constantly recurring daily presence such as the sun, his source of light and heat and therefore the giver of life.

The most deeply rooted desire in the human breast from the beginning of time has been that for immortality, "to dwell in changeless prime of body and of soul," and the search for an elixir of life which would bestow this condition on him led early man to worship that which appeared to possess this much desired property. This he found in the teeth; for, from the persistence of these organs after the disintegration of the rest of the body and the destruction of such vital organs as the heart, the brain and the liver, these old observers must have argued that the teeth were immortal, and as such were connected with the sun, that symbol of vitality and immortality.

From his daily experience, he would gather that the loss of teeth meant an impairment of health and strength; he could not eat so well, he could not fight so well, not only from loss of strength, but because, to begin with, he used his teeth as weapons to bite and to kill his foe, and he noted that weak creatures such as infants and the aged had few or no teeth at all. He would observe that powerful animals had strong tusks, formidable weapons, particularly in the male. Therefore, the canine teeth would be selected as objects of special worship.

Marcel Baudouin has studied this early connection between the teeth and the sun for many years. He says that the earliest decorations with which man adorned his body were circlets or necklaces, in Chellian times, made of pierced shells, which were very early replaced by teeth, strung in a simple circle to begin with, but later embellished with a pendant representing the sun. These circles or necklaces of teeth were worn as insignia of office, as the chains of office are worn today by kings, mayors and presidents. The necklaces of teeth worn today by primitive chiefs have the same significance.

The number of teeth in these circles, at first ten, then twelve, seems to suggest that they were intended to represent the signs of the zodiac, and the pendant, being the canine, would mean that that tooth was regarded as the sun, and this is confirmed by the story of the tooth in Kandy in Ceylon.

The Dalada Malegawa, the domestic temple of the king, contains the most precious thing in the world, a palladium. It

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is enshrined in an inner room in which there is no natural light. The splendor of the place is striking. The roof and walls are lined with gold brocade, gold and gems hang in festoons round the shrine and sweet-smelling flowers fill the place with their perfume. The receptacle of the tooth is wrapped in pure gold in a case of gold covered with emeralds, diamonds and rubies put into a small gold karandua, richly ornamented with rubies, diamonds and emeralds.

This tooth has been the cause of the outpouring of blood and treasure and the perpetration of much fraud. An age-long strife has been waged for its possession and to determine the truth regarding its origin. The Tamils hold that it is the tooth of Hanuman, the monkey god, while the Buddhists insist that it is the upper left canine tooth of Buddha. An ancient story found inscribed on a pillar in Pali verse describes a contest between the followers of the two cults for the possession of the tooth, all the details of which point to the fact that this tooth was regarded as the sun. It shone like "the sun rising behind the mountain of the morn," when an attempt was made to pound it upon an iron anvil. When placed in a bowl "of delightfully pure water," it travelled in circles and to the right hand. When flung into a charcoal brazier, a lotus arose in the heart of which glowed the tooth, which gave rise to the formula "om mane padme hum," "lo! joy is in the lotus." When thrown into the sewer in which all the filth of the town collected, this sewer became "pure as a pond in the Nanda heaven." Pilgrimages were made to the town where the tooth was kept, and one particularly devout prince who came and married the ruler's daughter He'ma'ma'la', took a vow never to let the tooth out of his possession, and in consequence was given the title of Danthakuma' ro', the first custodian of the Tooth, an office which exists even today. In one of the fierce wars for the possession of the tooth, danger threatened it, so that the prince and princess were forced to escape with the tooth concealed in the hair of the princess, and after many wanderings, the holy couple arrived in Kandy, in Ceylon, where they were received by a devout ruler, who placed the tooth in the shrine where it is today.

The lines in an old Vedic hymn seem to suggest the destroying aspect of the sun, that of Siva, the destroyer:

Two tigers have grown up who long to eat the Mother and the Sire
Soothe Brahmanaspati and thou O Jatavadas both these teeth
Let rice and barley be your food, eat also beans and sesamum
This is the share allotted you, to be your portion ye two teeth
Harm not your Mother and your Sire.
Both yellow teeth have been invoked, gentle and bringing happiness
Else whither let the fierceness of your nature turn away O teeth
Harm not your Mother and your Sire.

This worship of the tooth as the sun would appear to explain the elaborate care of the teeth shown by the ritual observed in the toilet of the mouth by the Hindus from ancient times to the present day, and the superstitious fear engendered by the loss of teeth, driving persons so deprived to extremes in their endeavors to conceal such a loss. Even Pushan was supplied with artificial teeth by the Asvins "twin sons of the sun." It is no idle conjecture to surmise that artificial teeth were supplied from the earliest times for this very purpose.

Disease of the teeth has always been regarded as one of the worst ills and attributed to the enemy of the sun; that is, the darkness, personified as the serpent or the worm. In the Babylonian legends, Tiamat, the worm, is the enemy of Samas, the sun-god, and in the earliest

toothache charm in existence, she comes weeping. The charm runs like this:

After Anu made the heavens, the heavens made the earth, the earth made the rivers, the rivers made the canals, the canals made the marsh, the marsh made the Worm. The Worm came weeping to Samas came unto Ea her tears flowing—"What wilt thou give me for my food?" "What wilt thou give me to destroy?" "I will give thee dried figs and apricots." "Forsooth! what are dried figs to me and apricots? Set me amid the teeth, let me dwell in the gums, that I may destroy the blood of the teeth, and of the gums shew their marrow. So shall I hold the latch of the door."

This was an unfortunate remark, because it exposed her scheme for the conquest of the sun-god and holding him in prison. Samas is aware of this and says, "Since thou hast said this O! Worm, may Ea smite thee with his mighty fist."

A conclave is held in heaven and Marduk is chosen to hack the body of Tiamat in pieces. He armed himself, filled his body with fire, leaped upon her body and smashed her skull, and as a reward received gifts from the gods his fathers.

When charms for toothache have been introduced, it is legitimate to assume that the teeth have reached a further stage and have passed from being the sun to being under the protection of that luminary. All the earliest remedies for toothache bear this out, for they are connected with sun worship.

Among the early Egyptians, the remedy for toothache was to split the body of a living mouse in half and to lay it while still warm along the gums of the sufferer. According to Prof. Elliot Smith, the mouse was regarded by the Egyptians as an antidote to death and in some way under the special protection of the sun. It is interesting to remember that one of the titles of Apollo was Smintheus, the mouse god, and, in his temple at Troad, the image of a mouse was placed by his tripod. Another sun animal is the lizard and another title of Apollo was that of Saurochthonus, the lizard god. Among the gypsies of the East, there is a toothache remedy consisting of the lungs of mice and the livers of lizards pounded and mixed together and placed in the aching tooth. The ancient Greeks pounded the body of a freshly killed mouse, mixed it with powdered marble and put it in the hollow tooth. It has always been a matter of perplexity and one which has stimulated careful search, that no case of operative treatment has ever been discovered among the thousands of mummies which have been examined during the last half century. If such remedies as those just mentioned were applied, this lack of evidence may be explained. Again, I would venture to suggest that another reason for this might lie in the fact that the kings of Egypt were sons of the sun, and heaven descended, and would naturally be expected to have perfect teeth. They probably had, but that they suffered acutely from exposed pulps and abscesses is shown by the evidence in their jaws. The excessive abrasion of their teeth was due to the silicate from the mill stones used in grinding their flour becoming mixed with their food.

The practice employed in ancient Mexico, and common in all parts of the world today, of dropping the cast teeth of children into a mouse hole and saying, "Mouse, mouse, give me your iron tooth and I will give you my bone tooth," is undoubtedly a relic of sun worship, for mice and allied rodents are associated with the sun in all these countries. Apollo, who visited the plague on peoples when they incurred his wrath, is invoked in the first book of the Iliad by his priest Crysis under the title of Smintheus, when plague fell upon the Grecian host. The Arabs worship the jerboa, a small rat whose mother is a lightning goddess. The Bohemians bite off the heads of living mice and make them into necklaces to

hang around the necks of teething infants to prevent convulsions. Apollo was invoked for convulsions as well as for plague.

The same idea underlies all the plant remedies. The evergreens, which are bound up with sun worship, were also remedies for toothache. The ivy, which was sacred to Osiris, is prescribed by John Arderne in the fourteenth century for the extraction of teeth. "Let the tooth you want to remove be rubbed with the gum of ivy and it will immediately fall out." And Gerarde, the herbalist, says, "The berries of ivy pounded and made hot and dropped in the contrary ear easeth the toothache." And the peony, so named after Apollo or Paean the Healer, figures strangely in the history of dentistry and is connected mostly with teething, being employed in the form of necklaces round the necks of teething infants to prevent convulsions.

The plant which has been the cause of much fraud for centuries is the henbane or hyoscyamus. This has the most complicated history of all the remedies, for it combines in it the idea of the god and the worm, and, in the most confused manner, the struggle between light and darkness; for its name, given by the ancient Greeks of Huoskuamos, hog's bean, has a far away suggestion of the legend of the death of Adonis and Attis, both of whom were killed by a boar and had to spend a certain part of the year in the lower regions. The story of the contest between the goddesses of light and darkness, for these heroes who were impersonations of the sun, is the same as that concerning the contest between Samas and Tiamat in the Babylonian legend. It is difficult to understand how the idea arose or why the seeds of this plant should have been sprinkled on hot coals in the first instance unless it was in some forgotten ritual. During the process, it must have been observed that the seeds so treated, burst and expelled little wormlike bodies. Perhaps some early ministrant performing this rite may have been suffering from acute toothache at the time of his ministrations and the vapor arising, being an anodyne, gave him relief and he deduced that this came from the fumes so inhaled. The early legends all seem to suggest that the enemy of the teeth was some kind of worm, and the priest who was taught to observe phenomena connected with his sacrifices, putting two and two together, would conjecture that these little wormlike bodies were the enemies which had been assaulting his teeth. Scribonious Largus, physician to the Emperor Claudius in the first century of our era, says in his book on materia medica, that if the seeds of hyoscyamus are sprinkled on hot charcoal and the vapor is inhaled, toothache will be relieved, and he continues that if the mouth is rinsed out afterwards, little wormlike bodies are expelled. He does not say that these bodies are actually worms, for he says "quasi vermiculi." This has been the source of much quackery through the centuries and in every part of the world. The story of the worm in the tooth appears in all literature, in both the old and the new worlds. It is another instance of the close analogy of the stories in India and Yucatan; for, in the Popol Vuh, the sacred writing of the Guatemalans in Central America, there is the story of how two youths obtained power over Vukub Cakix and persuaded an aged couple, whose business it was to remove worms from the teeth, to extract the king's teeth and replace them with white maize grains; a story which resembles that of the Asvins and Pushan.

The Latins called the henbane "Apollinaris," that is, belonging to Apollo, or "faba Jovis," Jove's bean. The folk lore of this plant is obscure. The custom of

easing toothache with the vapor is still practiced in different parts of the world, with or without the fraud of the worms. Quacks used to make their remedies more convincing by the conveyance of small pieces of catgut to the rinsing water, pretending that these were the worms that had been gnawing the tooth and causing the pain.

When it is remembered that the teeth were believed to contain a supernatural force conferring on their owner all that is most valuable in life, it can be understood why, in the earliest codes of laws, such severe penalties were exacted from the person who, by accident or design, deprived another of his teeth—the law of a tooth for a tooth. Therefore, the teeth, being held as so precious from some lingering memory of the time when they had been worshipped as the sun, still ruled in man's subconscious mind. From this, it can be understood why the operator on the teeth should have been so despised that his ranks could be recruited only from the lowest grades of society, and a further consideration of the origin of the calling will reveal the reason for this antipathy to the person, who, like the Amalekite in the story of Saul, "would stretch forth his hand to destroy the Lord's anointed." Mr. Warren Dawson has pointed out that the attendant who made the first incision into the corpse in the ritual of mummification was driven away with missiles and objurgations. The same hard hap may have befallen the early toothdrawer, in spite of Cicero's assertion that the inventor of toothdrawing was the third Æsculapius. This, too, may account for that leaden pair of forceps which was placed in the Temple of Apollo at Delphi, which has been the subject of age-long conjecture. Some authorities assert that it was placed there as a warning not to extract any tooth until it was loose enough to be extracted with an instrument made of lead. Professor Sambon says that it was placed there as a votive offering by an early toothdrawer. What seems to be the most feasible explanation is that it was a votive offering for the expiation of the crime of sacrilege.

The surgeon, like the toothdrawer, was a shedder of blood, and Thomas Gale, writing in the fifteenth century, says of surgery, "Few that have well brought up their son will put him to the art, it is now so beggarly and vile." In 1163, Pope Alexander the Third forbade the clergy to interfere in matters of surgery or to engage in any works which involved the shedding of blood. It may have been a combination of these prohibitions, with the added fear of the person who would deprive another of his vitality or even of his immortality, which bred a distrust of the toothdrawer in the minds of the people. Just as the office of the executioner or hangman is so abhorred that few self-respecting citizens will think of entering such a walk in life, so it was with the early toothdrawer who was often called on to extract teeth as a punishment for crime. The fourteenth century carver of the miserere seats in Ely Cathedral depicted the toothdrawer with a cloven hoof.

Apart from that oft quoted reference in Herodotus to specialists for the teeth in Egypt, and the mention by Martial, in one of his satires, of Cascellius as an extractor of aching teeth in Rome, there is little to suggest that toothdrawers were numerous in the early centuries. That diseases of the teeth existed is obvious, but the first mention of such a calling as toothdrawing, apart from barbery and surgery, is to be found in the fourteenth century manuscript of Guy de Chauliac, in which he speaks of "dentatores."

The first illustration of a toothdrawer is also in a fourteenth century manuscript

in the British Museum. The toothdrawer is using enormous forceps to which he is applying both hands, but his most conspicuous feature is his necklace of teeth. Did he wear it as a relic of ancient mysticism? It is difficult to say. Sir James Frazer, in "The Golden Bough," says that the wreaths of laurel worn by the victors in the Pythian games were first of all worn as amulets or a protection against the pollution of blood. The necklace of teeth may have had the same idea underlying it. The reverse process seems to have taken place with these necklaces, to that of the wreaths of laurel, for they came to be worn as decorations of honor, while the necklaces of teeth, at first insignia of office, later became a means of protection against the pollution of blood, then part of the distinctive dress of the toothdrawer, and later, losing even this significance, were used merely to attract attention, just as he wore in his cap the leaden image of a saint in the form of a brooch discarded by some pilgrim who had obtained it as a token that his pilgrimage to the shrine of that saint had been performed.

The meaning of his monkey, too, must be left to somewhat lively conjecture. Monkeys have a good deal to do with the teeth. That tooth in Kandy, in Ceylon, is claimed by the Tamils as the tooth of Hanuman, the monkey god, and the first illustration of the operation of extraction, carved on the ancient stupa of Barut, built between 300 and 200 B.C., shows monkeys extracting the upper left cuspid tooth from a giant. One of the impersonations of Vishnu, worshipped by the Tamils, was as Kapi, the monkey, "who spills" or produces rain, and teeth were and are used as rain charms. In Australia, among the aborigines, a victim is chosen and his teeth are knocked out that his mouth with its dark empty interior may resemble the dark raincloud; in other words, the sky deprived of its sun.

Now in the Saxon Leechdoms, Starcraft and Wortcunning, there is a sentence, "The teeth which the Greeks call organon, that is in our language, bliss." This word "bliss" occurs in the contemporary sacred writings, "The Heliand" or Saxon Gospels, according to Skeat, associated with the sky and is allied to "blican," to shine. Thus, the sentence would read today, "The teeth which are our sun"; and so Kapi, the monkey who spills or produces rain, is the monkey who deprives the sky of its sun, or extracts the teeth from the mouth. An early German print shows monkeys extracting teeth in the market place, and the toothdrawer's constant companion was a monkey.

There is no doubt that the toothdrawer kept low company, for he appears in several accounts in somewhat disreputable society. For instance, in that curious fragment "Cock Lorel's Bote," printed by Wynkin de Worde in 1500, he appears with other vagabonds, among whom was Matthew, the Toothdrawer of London. In the Record Office of London, there is an entry in the Pipe Rolls of 1399, of one Matthew Flint who was appointed to an office which would be regarded as that of state dentist today. This same Matthew was to receive sixpence a day to do "all that pertains to his art to any of our poor subjects who shall at any future time require it without receiving anything from them on that account."

Another entry, this time in the Colchester city rolls, records an action for damages against a barber, one Richard Feryer or Farrier, for extracting the tooth of Joan Juell and breaking her jaw and lacerating her tongue, with the shedding of blood. Happily for himself, Feryer proved that the accusations against him were without foundation.

All through the centuries, the toothdrawer may be shown wearing either as a decoration or as part of his costume, or by the titles which he adopted, vestiges of this far-away association between the teeth and the sun. One of his titles, recurring frequently even into our own time and shown by its use as the title of a polka, was that of Belphegor, a title which must have been handed down through the centuries and its original meaning entirely forgotten. Belphegor was the god of the Moabites, and comes into the story of Balaam, Bel or Baal, the sun god, literally "he who possesses," and Peor or Phegor, the mountain.

It is interesting to remember in this connection that Sir Walter Besant, in his history of London in the eighteenth century, records that a dentist, a certain Dr. Clark, who claimed to be dentist to Charles II, lived in Fountain Court, Strand, at the sign of "The Sun and Eye," and that his motto was "Post Nubila Phoebus."

Even today, relics of sun worship exist among us, seen in the custom of throwing children's cast teeth into the fire and among the Arabs there is the custom of throwing shed teeth toward the sun.

I have elaborated elsewhere the connection between the patron saint of toothache and the sun, and again her connection with the toothdrawer. She is shown in a sixteenth century illuminated manuscript as a toothdrawer, and in the dialogs of Sir Thomas More, the messenger from Luther says, "St. Apolyn we make a toothdrawer." There is a most interesting illustration of Apollonia in the celebrated Luttrell Psalter, in which she is holding in her hand a circlet of teeth. In the calendar of saints, the day allotted to Apollonia is the ninth of February, just two days later than the birthday of Apollo, whose festival at this time of year was called the "Apollonia." Again, this saint is associated with Osiris as well as with Apollo, for in Guernsey there is a chapel dedicated to St. Apolyn in the fifteenth century. The natives of the island go to this chapel, when suffering from toothache, and pick the ivy leaves growing on the walls, to chew them for the relief of the pain. Again, in Rome, in the Agostino church, built in the fifteenth century on the site of the oldest temple in Rome, the Temple of Apollo, there is a chapel dedicated to St. Apollonia, to which young girls born on her day, the ninth of February, used to repair when they came to marriageable age to receive a dowry and a necklace of peony roots.

The most ancient inscriptions show that the sun was originally a goddess. In Hebrew, Shemesh, or Samas, is often feminine. The North Semitic male sun god came later. In the Spanish toothache charm, Apollonia is represented as telling the Virgin, who "passed by," that she is dying of a pain in her teeth, and the Virgin replies, "By the bright star Venus and the setting sun, you shall never have toothache any more."

It is strange that prehistoric man should have invoked the sun for help in dental and oral diseases, that mediaeval man translated the sun into a saint in order to have her intervention when his teeth ached and that the latest remedy in modern therapeutics should be that of artificial sunlight.

At the Royal Dental Hospital, London, England, patients receive body baths of artificial sunlight to raise their resistance to dental and oral diseases. Thus, the whirligig of time brings in his revenges, and King Sol comes into his own again.

ORAL INFECTION IN RELATION TO SYSTEMIC DISEASE: RECENT STUDIES (THE VIEWPOINT OF AN INTERNIST)*

By WILBER E. POST, M. D., Chicago, Ill.

IT IS appropriate that members of your Association and guests have the privilege of seeing here in Chicago the tablet on which is found the earliest known record of the observation of the relationship between disease of the teeth and systemic disease. As most of you probably know, this ancient tablet records that the physician of Assyria Arad Nana wrote of the prince Ashur-bani-apal these words: "The pain in his head, his sides and his feet has come from his teeth; they must be extracted." The date of this record is thought to be about 680 B. C. Long centuries later, in A. D. 1801, Benjamin Rush wrote: "I have been made happy by discovering that I have only added to the observations of other physicians, in pointing out a connection between the extraction of decayed and diseased teeth and the cure of general diseases." He mentions the observations of a Dr. Darwin; Dr. Petit, a celebrated French surgeon, and a Dr. Siebold. The general diseases mentioned were: rheumatism, dyspepsia, epilepsy, headache, vertigo and irregularity of menstruation. He adds: "I am disposed to believe they (the teeth) are often the unsuspected causes of general, and particularly of nervous diseases. . . . I cannot help thinking that our success in the treatment of all chronic diseases would be very much promoted, by directing our inquiries into the state of the teeth of sick people, and by advising their extraction in every case in which they are decayed. It is not necessary that they be attended by pain in order to produce disease."

Following this came the discovery of bacteria as disease producers, and the long list of studies on the bacteria of the mouth by many men, foremost of whom was your own G. V. Black. Then came the establishment of Koch's laws by which specific bacteria were determined to be the cause of certain definite diseases, and, finally, the application of these laws in the establishment of our knowledge of focal infection. In this last advance, most of us believe Dr. Billings was the leader. It is interesting to note that it was before the dental profession of Chicago in February of 1913 that Dr. Billings told of the origin of his interest in oral sepsis. He said: "My attention was first called to oral sepsis as related to systemic disease, a good many years ago, because of the interest I then took in progressive pernicious anemia, more especially because of a statement made by Hunter (William) of England that pernicious anemia had as one of its most important causes oral sepsis with a resulting toxemia and impoverishment of the blood."

Since then, so many observations have

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjuction with the Chicago Centennial Dental Congress, Aug. 8, 1933.

been made; so much studying has been done; so much has been said and written on this subject, that I have a considerable reluctance in discussing it before this important assembly. There may be justification. To most of those in your profession and in mine, the principle of focal infection seem firmly established. Nevertheless, only recently a prominent practitioner of medicine told me that he thought the whole idea was wrong. There must be some in your profession who share his view. Certain it is that many teeth have been extracted in the last twenty years on account of general disease and without apparent benefit. On the other hand, there are those in both professions who are convinced that all pulpless teeth ought to be removed. While they have real evidence to support this position, most of us would at present be quite appalled at the thought, and doubtless there would be resistence by the patients themselves. We are confronted by many individual cases in which the correct procedure is in doubt, and we should welcome information and discussion leading to a means of arriving at wise decisions in those cases. Such a discussion might profitably include the following subjects: 1. Clinical observations and procedure. 2. The use of so-called vaccines, or bacterial suspensions, and other bacterial products for diagnostic or therapeutic purposes. 3. Studies of the bacteria at the root ends of pulpless teeth. 4. The measurement of the negative electric charge of bacteria (called the cataphoretic potential) for the purpose of determining the specificity of bacteria and the identification of foci of infection.

TABLE 1.—RESULTS OF CULTURES MADE FROM APICES OF TEETH

	Number of Cultures	Percentage Having Ten Colonies or More	
R. L. Haden			
Roentgen-ray negative	600	46.2	
Roentgen-ray positive	500	62.8	
Vital teeth	400	4.8	
		Percentage Having Higher Counts Than the Controls	
Dick and Rhoads			
Pulpless roentgen-ray negative	29	51 7	
Austin and Cook		Positive	Negative
Vital teeth	100	4	96
Pulpless—Roentgen-ray negative	50	89	11
Roentgen-ray positive	50	94	11
Henrici and Hartzell			
Vital teeth	22	0	22

CLINICAL OBSERVATION AND PROCEDURE

In regard to clinical observation and procedure, an appropriate question is: Why, after twenty-five years of modern study of focal infection in and about the teeth in relation to systemic disease, do we still meet the ultra-conservative views, and real doubt and actual disbelief? In large part, the answer is in the following:

1. The removal of the infected tooth has been depended on as the only thing

necessary to cure the infected rheumatic joint, when, of course, the elimination of the dental infection does not remove the infection in the joint tissues at all. The joint tissues must also be treated appropriately. Both patient and physician should take this into account, and also should appreciate that eradication of infection in tissues, and the restoration of tissues, with so meager a blood supply as those about the joints is a difficult affair.

3. There are other causes of arthritis than infection, such as trauma of the joint structures incident to malformation of the feet or a misfitting of shoes, or excessive weight of the body or accidental injury. Or there may be gout, or at least hypometabolism, especially in women passed the climacteric; perhaps hypothyroidism, or errors in diet, especially

TABLE 2.—RESULTS OF TWO HUNDRED TWENTY CULTURES MADE FROM APICES OF TEETH (ONE HUNDRED TWENTY-NINE CASES)

Cases with Roentgen-Ray Evidence of Infection		Number of Cultures Made	Number of Positive Cultures (Short Chain Streptococci)	Number of Arthrotropic or Neurotropic Cultures Corresponding to Clinical Condition
Neuritis	39	52	52	50
Arthritis	22	45	45	42
Other conditions	18	43	40	5*
Cases with Roentgen-Ray Negative Teeth				
Neuritis	30	50	46	42
Arthritis	20	30	30	28
	129	220	213	

*Of the eighteen cases other than arthritis or neuritis, five cultures were found to be arthrotropic in character. These patients gave a history of slight attacks of arthritis, but were free of symptoms at the time. (Sixty-nine cases of neuritis; fifty reported under treatment.)

There are cases in which prompt relief follows the removal of the focus of infection. This I think is due to the fact that the joint disturbance in those cases is an allergic phenomenon and the removal of the focus of infection eliminates the source of toxin.

2. Other foci of infection than those about the teeth may be the source of infection and may be difficult to demonstrate. At any rate, whether the actual infection originated in one or another focus may be impossible to determine.

in those passed middle life who eat too much, or in the elderly whose blood vessels have lost their full respiratory function. In the case of neuritis, it may not be noted by the physician that, on a hot summer night when the patient was tired and his skin wet with perspiration, he was chilled while driving home from playing golf, or, if in winter, that he drove his automobile while resting his arm in the open window. When a fleshy

person has an intercostal neuritis, it is not apparent without a roentgenogram that there is an advanced traumatic osteoarthritis of the thoracic vertebrae which accounts for the neuritis.

Occasionally we see all of the teeth removed from one side of the upper jaw for the purpose of relieving a tic douloureux, but no relief comes, and it never does come in that terrible malady by that means. On the other hand, a patient with genuine neuritis of the same nerve may be allowed to suffer too long because it is difficult to locate the tooth in which the pulp is dying; in which case, relief comes almost immediately if such an infected pulp or the tooth is removed.

We are learning more about the importance of vitamines, and the condition of the intestinal tract and allergy in relation to general disease; which may help us to differentiate between those diseases due to infection of the teeth and those due to other conditions. Only by full consideration of all of these factors can we, in some cases, arrive at a fair judgment regarding doubtfully infected teeth in relation to general disease.

TABLE 3.—RESULTS OF TREATMENT

		Free of Symptoms	Definitely Improved	Slightly Improved	Questionable or No Improvement
Arthritis, Ninety Cases					
Foci only removed*	10	5	3	2	0
Vaccine treatment†	30	10	17	0	3
Filtrate treatment‡	40	15	18	3	4
Diet and hygienic measures	10	0	2	5	3
		30	40	10	10
Neuritis, Fifty Cases					
Foci only removed¶	25	20	5	.....	.....
Vaccine treatment#	10	5	5	.....	.....
Filtrate treatment§	15	5	10	.....	.....
		30	20	.....	.....

*In five of these cases, the foci were roentgen-ray negative devitalized teeth.
†Twenty of these cases had foci removed; eight cases with devitalized teeth.
‡Twenty-five of these cases had foci removed; twelve cases with devitalized teeth.
¶In fifteen of these cases, the foci were roentgen-ray negative devitalized teeth.
#All had a focus removed; five cases with devitalized teeth.
§Twelve had foci removed; ten cases with devitalized teeth. (Vaccine from 24-hour culture was employed.)

USE OF SO-CALLED VACCINES, OR BACTERIAL SUSPENSIONS, AND OTHER BACTERIAL PRODUCTS FOR DIAGNOSTIC OR THERAPEUTIC PURPOSES

The use of inoculations of suspensions

of dead bacteria, or of bacterial products, and of serums for diagnostic and therapeutic purposes has left much to be desired. We hope for better things when we think of the newer studies on the reactions of the reticulo-endothelial system, the work of Besredka of the Pasteur Institute on local immunization and the refinement in the preparation of immune serums. The use of the precipitin and agglutinin reactions has been a new aid in the determination of specific infection in these diseases.

Before discussing another phase of this subject, let me explain that in their work on scarlet fever, the Doctors Dick were successful in obtaining an antitoxin because they used as antigen, the toxin produced by the growth of the streptococcus in its culture mediums. It occurred to me that the toxin of the streptococcus of rheumatism should be used in the study and treatment of arthritis. Willard L. Wood has been carrying on this work. When the filtrate of an autogenous broth culture is injected in minute doses into the skin of the patient, three things may occur: (1) the local reaction may be very marked, causing a large area of redness and swelling and burning and soreness lasting from twenty-four to forty-eight hours; (2) previously affected joints and bursae may become very painful for a period of a few hours to one week, and (3) the tissues at the site of the original focus of infection, such as ethmoids or sinuses, may become swollen and painful. The reaction resembles that seen in a tuberculous lesion when old tuberculin is injected subcutaneously. Similar reactions were formerly observed from time to time in cases of rheumatic arthritis when autogenous vaccines were injected subcutaneously. These vaccines were essentially suspensions of dead bacteria, while the material used in our recent work is a filtrate of the broth culture of the organism.

I do not recall any case in which the tissues at the site of the original focus were disturbed by injections of suspensions of dead bacteria, while such disturbance has been rather frequent and marked since the filtrate of the broth culture has been used. One of the benefits from the latter is that previously obscure foci of infection are revealed and appropriate steps may therefore be taken to eradicate the infection. Further, the affected tissue about joints, bursae, occasionally may improve markedly after the reaction. Indeed, this is the basis for use of the toxic bouillon filtrate as a therapeutic agent. At any rate, such a reaction is an indication that the toxin used is specific for that patient's infection. While original foci of infection in the nose and throat have been revealed, I do not recall that foci about the teeth have been revealed by this procedure. Joints and nerves affected by rheumatic infection may show a typical reaction when the filtrate of the bouillon cultures of the streptococci obtained from tooth infection has been used.

STUDIES OF THE BACTERIA AT THE ROOT ENDS OF PULPLESS TEETH

Studies on the bacteria at the root ends of pulpless teeth in recent years by Haden, and Rhoads and Dick, Austin and Cook, Henrici and Hartzell have revealed striking and important results. Of special interest are the results of Rhoads and Dick, who obtained positive cultures from the root ends of every pulpless tooth in a long series 51.7 per cent of which had higher counts than any of the controls. Haden found 48 per cent with higher counts than the controls. The average number of bacteria obtained was 750,000. From teeth with vital

pulps, the average count was 2,000. Most of the organisms obtained were streptococci. Years before this, A. D. Black found that 47 per cent of pulpless teeth showed some roentgenographic evidence of bone absorption about the root ends in healthy individuals, and Dr. Duke found such evidence in 81 per cent of medical patients who were also of greater average age. Such facts as these make us inquire seriously as to whether it is possible to sterilize root ends once the pulp becomes infected and, if sterilized, will they remain so? Probably not all infected root ends will produce systemic disease, but when we consider that the tissue conditions there are favorable for the absorption of infection and its products, we know that every root end of a pulpless tooth will constitute a menace. We must recall also that Benjamin Rush said, 132 years ago, that he could not help thinking that our success in the treatment of chronic disease would be very much promoted by advising extraction in every case in which the tooth is decayed. Today, we might modify that statement by advising extraction when the pulp of the tooth becomes infected and when there is systemic disease not accounted for by other foci of infection. At any rate, we know that systemic disease derived from infected teeth is due to our efforts to retain infected teeth, whereby either the infection is retained or conditions are made favorable for infection to develop.

Only recently, Dr. Merrifield, of your profession, told me of his experience in cultivating streptococci from the canaliculi of diseased teeth having a vital pulp. In fact, he removed such a tooth from a patient of mine in preference to removing a roentgen-ray negative pulpless tooth. I concurred in his judgment, and hope that more complete identification of the organism found may be made.

MEASUREMENT OF THE NEGATIVE ELECTRIC CHARGE OF BACTERIA (CALLED THE CATAPHORETIC POTENTIAL) FOR THE PURPOSE OF DETERMINING THE SPECIFICITY OF BACTERIA AND THE IDENTIFICATION OF FOCI OF INFECTION

The determination of the cataphoretic potential of bacteria (i. e., the negative electric charge of bacteria) and its application in the field of focal infection has seemed to me almost a fairy tale. The method consists in observing through a microscope the rate of speed at which bacteria in a suspension will move from anode to cathode under a measured voltage. The method, known to physics for some years, was used to determine the electric charge of various particles in suspension. Within recent years, the procedure has been used in bacteriology. Lloyd B. Jensen, working with Falk at the University of Chicago, applied the method in differentiating various strains of diphtheria bacilli. He found that the same strains of bacilli cultured in definite and identical conditions always moved in suspension from anode to cathode at the same rate of speed. Nonpathogenic organisms or organisms once pathogenic that have lost their pathogenicity have no electric charge and, therefore, do not move regularly from anode to cathode in similar suspensions.

Jensen's work has been confirmed. It occurred to him that the method might be applied in the differentiation of various strains of streptococci. This was suggested to E. C. Rosenow at the Mayo Clinic and Jensen was promptly invited to Rochester. The result was that in tests of 5,000 strains of streptococci, the grouping according to their cataphoretic potential corresponded to the grouping already made by Rosenow according to cultural and biologic and clinical characteristics.

Still further, when streptococci of

arthrotropic potential are suspended in dilutions of serum of patients suffering from infectious arthritis, or when streptococci of neurotropic potential are suspended in dilutions of serum of patients suffering from infectious neuritis, the streptococci will not move from anode to cathode; that is, something in such a patient's serum causes the bacteria to lose their electric charge. We suppose that an antibody in the serum covers or combines with the bacteria and overcomes its negative charge. The serums of various patients differ in their power to decrease the potential of the bacteria, and the serum of the same patient may vary with time, probably according to his immunity.

Thus, we now have a method of determining electrically whether streptococci obtained from the nose or throat or teeth or prostate may be the cause of arthritis or neuritis; also, a method of determining whether the serum of a patient suffering from arthritis or neuritis contains an antibody for the arthrotropic, or the neurotropic, streptococcus.

Applied to the problem of the pulpless tooth of doubtful etiologic significance in a case of arthritis or a nervous system lesion, the method has distinct practical value in helping us to decide whether that tooth should be removed. We will agree that what may justify us in saving a tooth if it is not guilty or what warrents us in condemning and removing a tooth if it is guilty, thereby restoring the patient, is a real help.

SUMMARY

How shall we come to conclusions in regard to the doubtful tooth in a case of infectious arthritis or neuritis? We shall keep in mind the general principles of focal infection in respect to possible foci and systemic manifestations. We shall obtain from the patient a careful history of events from the very onset of trouble as regards both possible foci and systemic manifestations. We shall examine the patient carefully, including in the examination roentgen-ray films of the teeth. We shall remember that an infected pulpless tooth which is roentgen-ray negative may be dangerous. Perhaps we should remember that some pulpless teeth are not infected and are harmless. We shall exclude if possible other foci of infection. This may require history and direct examination, bacterial cultures with serum tests and skin tests and also tests for allergic reactions. In various cases, we may need to exclude the possibility of gout and hypothyroidism and hypometabolism in general, and migraine and vascular disease (such as Burger's disease), or metatarsalgia from high heels or short shoes, or gallbladder disease with referred pain, or occupational neuritis, or angina pectoris, or carcinoma of the prostate, or pelvic disorders. "What a fanciful list," some would say. Verily, I can testify for many of us that this is the truth, but not the whole truth.

Finally, we shall estimate the degree of severity of the systemic disease, and the time and facilities reasonably at the disposal of the patient, form our conclusions in the light of the best we know, and always keep our minds open for new knowledge.

RELATION OF DIET TO DENTAL CARIES*

By HAROLD F. HAWKINS, D.D.S., Los Angeles, Calif.

IF EXPERIENCE has taught us anything it is that nutrition is the most important single factor in health. Dental health is no exception. If the body is in good chemical balance, i. e., adequately and properly nourished, there can be no dental decay.

W. D. Miller has given an accurate explanation of the cause of caries; but he did not explain why teeth failed to decay in the presence of fermentable foods. He gave us an explanation of the cause of caries, but failed to explain the cause of immunity. A knowledge of both the cause and the systemic forces that work for immunity is essential if we are to cope with the problem.

I propose in this discussion to take up the problem where Miller laid it down. We have a fermentable acid capable of disintegrating the tooth substance. This has been seen in the mouth and demonstrated in the test tube.

Chemically, there are apparently only two ways to stop the progress or chemical activity of an acid: (1) by its dilution to a point where it is too weak to have chemical activity, and (2) by its chemical union with some element or compound which renders the acid inert. The problem, then, is to neutralize or destroy the chemical activity of the acids of fermentation; otherwise, they will react chemically with the tooth's structure, reducing the density of the enamel or actually producing a cavity.

The neutralizing factors in the mouth either come from within the tooth, i. e., the pulp; or from without, i. e., the saliva. The fact that susceptibility or immunity to decay in pulpless teeth runs more or less parallel with that of vital teeth eliminates the pulp as a serious factor in caries.

The chemical composition of the saliva is without question the most important factor in immunity. It has to do with the neutralization of the acids of fermentation as well as controlling the density of the enamel.

Theoretically, we have four factors in the saliva that might be considered as to their influence on the acids of fermentation and the density of the tooth's structure: (1) the diluting action; (2) the level of mucin; (3) the level of ionizable alkaline salts, and (4) the level of calcium salts.

It might seem that an excessive amount of saliva would be an important factor in rendering the fermentable acids ineffective. We have noted that in excessively dry mouths there seems to be an increased tendency to decay. The fact that decay readily occurs in mouths with a copious flow of saliva discourages too much importance being given to the amount of saliva. We do not consider the amount of saliva secreted per day an important factor in the total incidence of caries.

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 8, 1933.

Mucin is a glycoprotein. All proteins have the capacity to take up acids. The majority of dentists feel that an increase in mucin promotes decay. This theory is contrary to the idea that mucin can neutralize the acids of fermentation. Our findings in several thousand cases indicate that the amount of mucin bears no relation to the incidence of dental decay.

It is generally recognized by dentists that mouth acidity promotes decay. Studies by different research groups, including us, show that, on an average, there is a slightly greater alkalinity in the immune state than in a state of susceptibility to dental caries. Alkaline salts, as dibasic phosphates, are the chief factors in this alkalinity of the saliva. The alkalinity of the saliva is without doubt an important factor in promoting immunity to decay.

The influence of calcium on fermentable acids can be readily seen. The fact that tooth decay occurs is proof of the ability of calcium salts to neutralize organic acids. In pyorrhea, the tendency to form salivary deposits is very apparent. These deposits are principally tricalcium phosphate and calcium carbonate. There is, as a rule, a high degree of immunity to caries, in pyorrheic states. Analysis of the saliva shows a marked increase in the level of calcium in a state of immunity over that of caries. It is evident that a high salivary calcium is associated with immunity.

The reaction of the saliva alone, or the calcium level alone, cannot be used as an index to the activity or lack of activity of caries. Immunity is dependent on two factors, the alkaline salts and the calcium level of the saliva. These two factors, which constitute the major buffer value of the saliva, must be considered together.

A suitable graph has been developed showing the influence of these two major buffer forces: the soluble alkaline salts and the calcium salts. Unfiltered saliva must be used for all tests, as calcium is not a readily soluble salt unless in an acid reaction. Considerable calcium in the saliva is in the colloidal state and will be lost by filtration. This colloidal calcium is used in nature to neutralize the acids of fermentation and must be accounted for in any technic establishing the buffer value of the saliva. The Kramer and Tisdall technic for total calcium determination is suitable in the vast majority of cases.

The soluble acid and alkaline salts can be measured by the colorimetric hydrogen-ion test. The specimen is permitted to remain in contact with the indicator until all chemical action is completed, which is usually an hour. This method will measure in a simple but accurate way the total neutralizing value of the soluble salts. The foregoing method as used is essentially a titration technic.

With our graph as a guide, it is possible to tell with a fair degree of accuracy whether a patient has or may have dental caries; i. e., it is a simple but accurate method of establishing the status of an individual as regards caries. Its reliability has been tested in thousands of cases.

In the adjustment of diet for the correction of caries or pyorrhea, it is necessary to know what is normal as regards the chemical levels of the body. We have found that the saliva and urine can be used as indicators in so directing the diet as to establish normal levels in the body.

	p_H	K	Ca	Cl	P	Ratio
Saliva	7.8	1.300	0.37	0.900	0.152	1
Urine	6.0	2.600	0.12	3.600	0.600	4

The foregoing levels have been found to be close to a suitable optimum level for normal function in the average case.

When more chemical values have been established it will be possible to adjust diets to a greater degree of accuracy.

To attempt to establish all cases on these levels would not be wise. In some pathologic states, deviation from these average normal values seems a favorable indication. The levels established are a valuable guide and can be used in the average case.

In attempting to regulate the body chemistry, we must know in what way certain classes of foods influence the fundamental chemical elements. In the control of dental decay as well as pyorrhea, the acid-base balance and calcium-phosphorus balance are all important.

Let us consider the influence of food on the acid-base balance and the calcium-phosphorus balance.

Alkalinity and acidity are influenced by (1) the vegetables and fruits, which tend to increase alkalinity; (2) meat, fish and eggs, which increase acidity; (3) cereals and grain foods, which increase acidity; (4) milk, which increases alkalinity, and (5) fats and oils, which increase alkalinity if properly balanced with starch.

Calcium in the body is influenced by (1) vegetables and fruits, which promote the holding of calcium; (2) meat, fish and eggs, which increase the loss of calcium; (3) cereals and grain foods, which increase the loss of calcium; (4) milk, which increases the level of calcium, and (5) fats and oils, which promote a loss of calcium.

Phosphorus in the body is influenced by (1) vegetables and fruits, which increase the holding of phosphorus; (2) meat, fish and eggs, which increase the level of phosphorus; (3) cereals and grain foods, which increase the level of phosphorus; (4) milk, which increases assimilation and elimination of phosphorus, and (5) fats and oils, which increase assimilation and elimination of phosphorus.

Chlorides are important from the standpoint of blood pressure and the level of hydrochloric acid in the stomach. Table salt and shell fish, such as clams and oysters, are important sources of chlorides.

Potassium is found in a great variety of foods, such as meat, fish, whole cereals, fruits and vegetables. If a broad diet is used, this element should not be deficient.

We have just considered foods and their influence on the acid-base balance and calcium-phosphorus balance in the body. There are many other factors and relationships that must be considered if we hope to place an individual in good balance. The question of assimilation is an important one.

In controlling the acid-base balance, we find the following facts important:

1. Any infections in the body are productive of acidosis. The action seems to be that of reducing the capacity of the kidneys to eliminate the acid phosphates. This is followed by a reduction in the alkaline reserve and is seen in a marked depression in the alkalinity of the saliva.

2. The level of the acid ash foods, such as meat, fish, eggs and grain, when too high, causes a loss of alkalinity unless the alkaline ash foods, the fruits and vegetables, are correspondingly increased. We find that about two-thirds alkaline ash foods and one-third acid ash foods makes for a good balance.

3. The importance of the unsatisfied fats in the diet has not been appreciated. These fats are necessary for the assimilation and elimination of phosphorus. The indications are that phosphorus is assimilated as a phospholipin and that fats aid the elimination of phosphorus through the kidneys. The saliva usually becomes

more alkaline and urine more acid on a high fat diet.

4. It has been found that organic acids which cannot be oxidized greatly depress the alkalinity of the body. When benzoic or oxalic acids are taken into the body in appreciable amounts in the form of plums, prunes or rhubarb, the saliva loses alkalinity and often becomes acid. There are other fruit acids, such as citric, malic and tartaric, which can usually be digested but cannot be handled by certain individuals. In such cases, a marked depression in the alkaline reserve occurs, often accompanied by skin rash, edema and aphthae stomatitis.

We find a suitable alkalinity of the saliva to be p_H 7.8. When the saliva falls below p_H 7.6, there is often a loss of gum tone. There is usually marked congestion and hypertrophy of the mucous membrane of the mouth when the saliva becomes distinctly acid. There are other conditions that cause a loss of gum tone, such as a lack of food massage and a lack of tone of the body as a whole.

Let us consider the calcium level of the saliva, which is our second important factor in neutralizing the acids of fermentation. The higher the level of calcium in the saliva, the greater is our immunity to caries; provided, of course, there is no change in the immunity that we secure through the alkaline salts.

What influences the level of calcium in the saliva?

1. The total level of calcium in the diet is important. The greatest concentration of calcium in food is in the bones of animals and fish. This source of calcium is in the form of tricalcium phosphate and calcium carbonate. We find this form of calcium to be readily assimilated and it appears to be the equal if not the superior of dicalcium phosphate, as far as our tests are concerned. We have had children on this form of calcium for a period of two years or more and have maintained normal growth and calcium levels without any evidence of dental decay.

Milk and milk products are our next concentrated calcium foods. We slightly favor sour or fermented milks over sweet milk as they cause less digestive disturbance and seem to afford better calcium levels. One quart of milk for a child and 1¼ pints for an adult seems to meet the average requirement. The amount of calcium carried by leafy vegetables and fruits is low. It is next to impossible to maintain suitable levels by feeding them without the aid of milk or bone.

2. The phosphorus assimilated governs to a very large degree the level of calcium in the blood stream. In the face of an excessive phosphorus intake, it is next to impossible to maintain a normal calcium-phosphorus balance in the body. Phosphorus is usually very easily assimilated and eliminated from the body. This is not true of calcium. Calcium is difficult to assimilate and cannot be readily eliminated from the body without the aid of phosphorus. Hence, a controlled phosphorus level is necessary for normal growth and maintenance. If the phosphorus is too low, caries often results. If the phosphorus is greatly in excess of the calcium, the density of the bony framework is reduced and pyorrhea is inevitable. The importance of a controlled phosphorous intake cannot be overestimated.

3. Vitamin D is a very valuable agent in stimulating the assimilation of calcium. Viosterol 250D is very effective if fed in high dosage. We use not less than 4 c.c. or 1 teaspoonful a day. An increase of over 100 per cent in assimilation in ten days has been secured on the above-mentioned dosage. We have never been able to secure satisfactory results on the usual dosage recommended. Vitamin D secured

by the use of ultraviolet light has given very satisfactory results, but its action is very slow compared to that of viosterol. Our tests show that it takes from two to three months to raise a refractory case to suitable levels. It has the advantage that it holds up the calcium level for a period of months after the treatment is discontinued.

While it has been stated in the literature that vitamin D has a direct action on phosphorus is increasing its assimilation, our tests have not shown this effect. In several hundred cases, we have yet to find the first evidence that vitamin D has any direct action on phosphorus assimilation.

4. Recent research by others seems to indicate that stearin is important in calcium assimilation, that calcium stearate is soluble in the intestinal tract in the presence of bile. Examination of stools indicates that calcium stearate is assimilated in the presence of bile, but not in its absence.

5. We have found that both pancreatin and bile have a marked effect on the assimilation of calcium. Bile salts and pancreatin in indicated cases have increased assimilation to a marked degree. It is not a serious factor in the vast majority of cases. When tests show that fats and oils are not being assimilated, it is wise to test for a bile or pancreatin deficiency.

6. The reaction of the intestinal tract seems to be a factor in some cases. We must keep in mind that it is only one of several factors and cannot be expected always to be at fault. We find that some cases respond to high lactose feeding with an increase in assimilation. There is a tendency to production of gas in high lactose or glucose therapy.

It is impossible to utilize properly or to eliminate calcium without an adequate source of phosphorus. All conditions influencing the assimilation and elimination of phosphorus are of great importance. The following influence the level of phosphorus in the body:

1. Lack of suitable forms of phosphorus. Most children suffer a serious phosphorus deficiency due to this condition. The animal forms of phosphorus are usually low in the child's diet. More meat, fish and eggs are strongly indicated. The use of vegetable forms, such as cereals, legumes and nuts, should be restricted. Most young children secure very little phosphorus from cereals unless cod liver oil is taken. The protein of vegetables is very difficult for children to assimilate and it would be the part of wisdom to keep it low and trust to animal protein. The average child would be much better nourished if potatoes were given for a starch and meat and eggs for a protein, and cereals kept quite low.

2. The presence of unsatisfied fatty acids, as has been stated, seems to be necessary for phosphorus assimilation. These fats are necessary not only for assimilation but for elimination as well. Meat eating races eat a high fat diet, which is necessary to maintain alkalinity.

3. A normal pancreatic and bile flow. This is essential if phosphorus is to be utilized. When the history shows an adequate supply of animal phosphorus and tests show a deficiency of this element, it is wise to feed separately pancreatin and bile and to check for an increase in assimilation.

4. A normal hydrochloric acid level in the stomach. This is necessary to stimulate the pancreas and liver. If fats and oils are very low, a high sodium chloride and phosphorus level tends to raise the acidity of the gastric juice as well as the blood pressure.

In the control of dental decay, we must maintain a high enough buffer value in the saliva to equal or neutralize the acids

of fermentation. As the fermentable acids vary somewhat from day to day, it is necessary to establish a buffer value with a good margin of safety.

The chloride level, while not so important as that of calcium and of phosphorus in relation to caries, is very important in maintaining the normal function of the body as a whole. Without chlorides, the hydrochloric acid level, the blood pressure and normal osmotic tension of the body cannot be maintained. In sodium chloride or table salt, we find the most satisfactory agent for maintaining this level. While it is apparent that there are other forces which are influencing the assimilation of chlorides, we find that the chlorides vary directly with the assimilation of unsatisfied fats and oils and the level of phosphorus. The values obtained for the normal level of chlorides in the saliva and urine are based upon hundreds of carefully recorded cases.

The widespread presence of potassium in foods and its level in the body partially attest to its importance. In the saliva and urine, we find that potassium assimilation varies directly with the fats and oils as well as with phosphates. It may be of interest to note that whereas the ratio of the level of the phosphorus and chlorine in the saliva to that in the urine is 1 : 4, that for potassium it is 1 : 2, as shown in an extensive study of normal chemical levels.

If we are to make progress in the control of dental decay through nutrition, we must depart from empiric regulation and adopt a rational technic. While diet regulation based on averages may be successful in a good percentage of children from fairly normal parents, this method of regulation is not very successful with adults. It is important to ascertain the chemical balance of an individual before any nutritional work is attempted. After determining that a certain element is below normal, the question is whether the intake is deficient or the difficulty is that of assimilation.

If we make repeated tests of the effects of our nutritional efforts, we are able to determine the success or failure of our plan of attack. If in poor calcium assimilation, tests are made, we can tell by watching the response to therapy whether the failure is due to a deficiency of vitamin D, a lack of acidulation of the intestinal tract or a deficiency of bile or pancreatin.

The success of this method has been such as to stimulate us to press on in an effort to discover more of the missing factors in nutrition. A higher percentage of successful cases is being obtained from year to year. Our results justify us in predicting that empiric regulation of diets will soon be a method of the past.

CONCLUSIONS

1. Dental decay is caused by the acids produced by fermenting starches and possibly sugars.

2. Dental decay is prevented by the buffer value of the saliva, which consists of the soluble alkaline salts and the calcium level of the saliva. Together they are responsible for this protection.

3. The acid-base balance and calcium-phosphorus balance are the principal factors in the production or absence of dental decay.

4. A knowledge of the normal chemical levels of the saliva and urine can be used as a guide in diet regulation.

5. The way in which different foods influence the chemical levels of the saliva and urine must be considered in the control of dental decay.

6. When the levels of certain elements are low in the face of an adequate intake, the forces and factors that make for an increase in assimilation become very important.

STUDIES IN THE SELF-SELECTION OF DIET BY YOUNG CHILDREN*

By CLARA M. DAVIS, M.D., Winnetka, Ill.

EARLY in 1926, I began the study of self-selection of diet by newly weaned infants at Mt. Sinai Hospital in Cleveland. The purpose of the study was to find out, if possible, whether such infants (ignorant as they are of adult ideas on the subject of diet and without experience with solid foods) could, at an early age, choose their diet from a list of simple, natural food materials commonly used by adults and, if so, how they would fare. It gives me much pleasure to recall at this time that the first report of this work was given by invitation before the American Academy of Periodontology at its meeting held in connection with the International Dental Congress in the same year, 1926.[1] By the spring of 1928, we had had such interesting results with three infants that the study was transferred to Chicago, where private generosity established a nursery for its accommodation. When, late in 1931, the nursery was closed, we had had fifteen children in all for periods of time ranging from six months to four and one-half years in individual cases, with accurate records in weighed or measured quantities of each food item eaten in the 37,500 meals served to them. The study is therefore the longest continuous and detailed study on the same group of human beings yet to be reported, as far as is known to me.

Both the experimental method in general and the list of foods in particular remained unchanged throughout the five years. The food list comprised: three fresh meats (beef, lamb, chicken); four glandular organs (liver, kidney, brains, sweetbreads); a yellow animal fat (bone-marrow); a sea fish (haddock); eggs; sweet and whole-lactic milk; five cereals (whole grains, ground by the old stone process and not heat treated); nine fresh vegetables; five fresh fruits, and sea salt. Canned and preserved foods, made dishes such as soups and custards and highly refined products such as sugar and incomplete cereals were excluded from the list, since in order to make the results clean cut and as free as might be from the possibility of ambiguous interpretation, we wished to offer for the choice of these infants only simple, natural foods, fresh, unmixed and unseasoned.

The three meals a day were arranged according to an unvarying schedule, each meal affording a choice of animal protein foods, milks, cereals and fruits or vegetables.

(In the beginning, four meals a day were served during the infant's first six months on the study. This practice was discontinued after the first three infants had been admitted, and thereafter all received three meals a day regardless of age,

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 10, 1933.

1. Davis, Clara M.: Self Selected Diet of Newly Weaned Infant, J.A.D.A., 14:1119 (June) 1927.

with nothing between meals other than water.)

The method of serving these children and their behaviour in eating is shown in a moving picture film. A detailed description of this, as well as of the foods used, methods of preparation, weighing, etc., was published in 1928.[2]

RESULTS OF THE STUDY

These babies and young children ate much more fruit, meat, eggs and fat than pediatricians commonly advise or than the average young child ever has a chance to eat, and less of cereals and the green leafy vegetables about which we hear so much in these days. To put it another way: Their protein and fat per kilogram of body weight per day was higher and their carbohydrate lower than the accepted standards. It is true that, as they grew older, and became active, romping children, they ate more cereals and vegetables and the protein per kilogram of body weight per day declined from the high average for the first six months of 4.1 gm., but even in the 3 or 4 year olds, it remained above the 2.5 gm. usually considered adequate. They thus reversed the pediatric practice of giving large quantities of cereals and vegetables to the newly weaned infant, and of giving more protein foods, meats and eggs as the child grows older. Cereals constituted but 0.25 per cent of the food intake of one infant (Peter C.) during his first six months; nor in the first six months period was it a major article in the diet of any. Only two or three children ever ate any spinach after the first week or two of the sampling of everything on the tray that all indulged in at the start, and the amount eaten by these during their entire stay was practically negligible. Lettuce was almost as unpopular as spinach and only a few ate cabbage in any important quantity. The favorite vegetables were, in the order of their popularity, potatoes, beets, carrots, peas—certainly four of those most generally liked and regularly eaten by adults.

The quantities of food eaten by these children, day in day out, were far larger than we pediatricians have thought necessary or good for the child. Anorexia was nonexistent among them, and it was apparent in watching them that their appetites were both better and keener than the average. The actual proof that they ate more is found in the record of their calories per kilogram per day. During the first six months periods, these averaged 112 for the group instead of the 80 considered ample for babies of their age. The individual range was 95 to 142; and, in each succeeding six-months period, their food intake as measured by calories continued to exceed the pediatric standard. Many children ate at times truly enormous meals. One often drank a quart of milk at a meal besides eating other foods; another had days each spring and fall when he ate from five to ten eggs for supper, and, in a motion picture, we see a 3 year old eating for his dinner almost a pound of lamb besides milk, rykrisp and some vegetables.

No two infants showed exactly the same combinations of likes and dislikes. In this respect, indeed, they behaved quite like human beings, since rarely, if ever, are the likes and dislikes of even members of the same family identical. Some liked almost everything; others liked only a few things at first but gradually enlarged their diet as time went on; while still others like relatively few things and held to these throughout their entire stay in the nursery. Evelyn W. exhibited a most striking example of the third type of diet mentioned. During her entire three years

2. Davis, Clara M.: Am. J. Dis. Child., 36:651 (Oct.) 1928.

in the nursery, she lived almost wholly on lactic milk, lamb, chicken, kidneys and liver, bone-marrow and orange juice, with only occasional bits of other foods. In the three years, she ate but 2½ pounds of vegetables and nearly half of this quantity was eaten in the first three months. Yet with this odd, almost carnivorous, diet, she received all the nutritional elements that are now known to be essential and was a large and exceptionally vigorous and healthy child. In fact, all three types of eaters fared equally well as far as we could determine. Moreover, the same three types of behavior in eating are commonly found in the dietary histories of the population at large. The variation of tastes shown by these children is of greatest interest, perhaps, in view of the fact that we pediatricians have in the past largely ignored the tastes of children and expected them all to eat the same things with equal gusto.

As one watched these children eat, and later in going over the records of what they had eaten, the impression was unavoidable that the performance of the group as a whole had been chaotic, each individual going his own sweet way, apparently without rhyme or reason, and making a dietary of his own out of the food materials equally available to all. The study, as far as the records of food eaten went, seemed to contribute nothing but disorder to the science of nutrition in which so many carefully planned experiments, especially with laboratory animals, had shown the orderly working of sound nutritional laws. But when the statistician began to turn in her reports of the analyses of their food records in terms of protein, fat, carbohydrate and calories per kilogram of body weight, we found that the appearance of chaotic disorder was but an illusion, since the protein, carbohydrates and fats bore an orderly relation to each other and did not differ widely in the group, and that both they and the calories underwent the usual reductions in proportion to body weight that are characteristic of increasing age and size in the individual. This finding of an essential orderliness and one that did no violence to the established fundamentals of nutritional science is strong evidence of the infant's innate ability to meet his metabolic needs without detailed direction from his elders *provided* such simple, fresh, unsophisticated foods as are on the list used in this experiment are abundantly available.

It was stated earlier that all the infants fared well and had better than average appetites. Some more definite information on their digestive and nutritional condition may be pertinent at this point.

Everything that they ate seemed to agree with them. None were constipated or ever needed or were given a laxative; nor, in five years, did we ever discover a stomachache. There were three brief instances of diarrhea, all in connection with an infection (parenteral) soon after admission.

For the appraisal of their nutritional condition, we have the following records of each child: daily weight, biweekly urine examination, monthly physical examination and height measurement, monthly complete blood count and hemoglobin estimation and roentgenograms of bones at intervals throughout entire stay.

Unfortunately, there are no standards of vigor, good spirits and endurance, which are of equal importance as evidences of good nutrition as are measures of height and weight. We can only say that, in the nutritional points for which there are standards, all the children, regardless of their condition when admitted, equalled or surpassed them, and were throughout healthy and vigorous, with overflowing good spirits and energy, and every appearance of optimal nutrition. Their red

blood cell counts ran higher than the accepted normals for their ages, their muscles were well developed and firm, their hair was thick, soft and glossy, and there were no fat or flabby children among them.

Nine of the fifteen infants were without clinical or roentgenographic signs of rickets when weaned, and remained so throughout the study. Six had some degree of rachitic change in bone, as shown by films made when they were admitted, of whom three had no clinical signs of rickets, one mild signs and two severe active rickets. The first of the two with active rickets (Earl H.) had cod liver oil put on his tray with his meals for him to take if he wished and took it in varying amounts for 101 days, then ceased to take it. Roentgenograms soon after showed the rickets to be healed. He was the only child who ever had any cod liver oil during the entire course of the study, and no child was ever given any other kind of antirachitic therapy. Yet without cod liver oil, Peter C., who had even more severe rickets, with badly bowed legs, was found free from the condition between three and four months after admission, and his legs straightened as time went on without treatment or restriction of his activity.

It has been a matter of deep regret that financial conditions made it impossible to continue the study and carry these children through to an age where the quality of their permanent teeth could be observed. The four oldest children when about 2 years old were given toothbrushes, which they used nightly before going to bed; while with the others (all children of 3 years or younger), no method of dental hygiene was used. None had the teeth cleaned by dentists, but all had dental examinations from time to time, the final being made by Corvin F. Stine of the dental department of the Children's Memorial Hospital. No caries was ever found in any and no decalcification of enamel. All teeth were reported to be well developed, with closed fissures. Three children showed a light tendency to green stain and the most interesting of the findings was that five children had slight and one child had large deposits of soft calculus, chiefly on the buccal surfaces of the deciduous molars. The child with the large deposits had a slight gingivitis from irritation from the deposits; otherwise, all gums were of healthy appearance.

Since the closing of the nursery, we have had the two oldest boys, Abraham G. and Donald R., in our family, and, during the two years, they have continued on much the same plan of feeding, with exclusion of sugar from their diet and the same liberal provision of fresh fruits, meats and vegetables. Their general health, spirits and vigor are a delight. They are now 7 years old and often walk 10 miles a day (by pedometer) and are almost never tired. They continue to eat larger quantities of food than the average child. To provide for the breakfast of two boys a quart of milk, five dishes of applesauce apiece, four bowls of cooked cereal with cream, seven eggs or three pairs of lamb kidneys, besides buttered toast and oranges or grapefruit is somewhat appalling from the standpoint of bills, but pays well in the satisfaction of seeing abounding health and vigor.

Both boys have their permanent lower central incisors and first permanent molars. Abraham G.'s are perfect in every particular. Donald R.'s lower central incisors are also, but his first permanent molars all had unclosed fissures and as one showed slight beginning decay soon after complete eruption, all fissures have had "kryptex" burnished in. Curiously, this boy likes everything and has always eaten much more of vegetables and fruit

than has the other, who cares relatively little for either and is a large meat-eater. It should be mentioned that Donald contracted a severe purulent nasal infection immediately after being brought to the Sinai Hospital for the beginning of his experimental period, which persisted for two months, with many profuse nasal hemorrhages, and was followed by chickenpox. Thus, he did not get started until almost 10 months old on food other than milk.

SUMMARY

The results of this study may be briefly summarized as follows:

All the children were able to select from the list of simple natural foods a satisfying diet and maintained excellent appetites. They so regulated both the varieties of foods chosen and the quantities of them that these were well within their digestive capacity as was shown by their freedom from constipation and digestive disturbances. Their nutrition as far as can be judged by present standards was of the best and the roentgenograms of their bones show their diet to have been fully adequate for normal bone development.

It may be said that until human bodies and minds are standardized (an unbiologic conception), standardized and mechanized diets, while they may be, and probably often are, improvements for the children of the poor and ignorant in cities, seem unlikely to produce optimal nutritional results, and, in many cases, as emphasized by Brennemann and others, when coupled with the struggle to get them eaten, are responsible for a high percentage of the anorexia so prevalent among children.

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DIET AND BONE DEVELOPMENT*

By WILLIAM J. CORCORAN, M.D., Chicago, Ill.

THIS review is not nearly so broad in its subject as the title "Diet and Bone Development" suggests. It is an attempt to find a place in the study of diet in orthodontia for an opinion based on an analysis of more than 5,000 office and clinic records of infants and children.

There is among clinicians and laboratory workers an entirely sincere belief that the so-called balanced diet represents something adequate and final in the essential requirements to normal bone development; and there is another equally sincere belief, held by a more recent group of investigators, that the ordinary dietary is deficient in lime salts, that, in fact, everyone is living in a state of calcium deficiency.

Many data have been assembled in support of each theory, and it was easy to select evidence on each side from my personal records. I found a large number of cases of bone hypoplasia in children receiving optimum amounts of lime salts in well-balanced dietaries; and I found also a large number of consistently poor eaters as well as neurotics who showed no hypoplasia of bone tissue even though

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the dietary was definitely deficient as measured by accepted standards. This led me to make a classification of convenience of all cases which showed osteoporosis even though careful attention had been given to the calcium content of the foodstuffs making up the diet, and of all cases which presented no clinical evidence of osteoporosis on dietaries deficient in mineral salts. This was designated the individual child group. Frankly, I was not always able to determine what factors were exerting a predominant influence in bone development in the children of this group, although obviously the dietary was less a factor than was something else.

I finally reached the conclusion that in a large number of children diet cannot be said to be an active cause of abnormal bone development and structure, and that if diet has a part at all in these cases, it is a predisposing rather than an active factor.

In reviewing journals of orthodontia, one finds considerable evidence that research workers are contributing an abundance of information bearing on diet in distoclusion. Clinical facts, as contrasted with the dramatic revelations coming at relatively brief intervals from the laboratory, are not so plentifully set forth in the literature. Clinical knowledge acquired in experiments with human subjects comes slowly. The cumulative process requires time; and so red-letter days appear less frequently in the clinician's calendar as accomplishments.

An unprejudiced reviewer of the literature will also detect the discordant notes of controversy and criticism. Brash's booming negations are, for instance, stimulatingly sincere, even though one favors the agreeable blending of clinical experience with the investigations of McCollum, Marshall, Sherman, the Mellanbys and others.

Knowledge about diet seems to be in a state of continuous change. The Neanderthal man depended on instinct in the selection of food; nowadays, fanciful advertisements tell us what to eat and where to get it. With the newer knowledge of mineral metabolism, the manufacturers of food products have become "steamed up" with the fuel of the public's food consciousness, and almost daily their clairvoyant calliopes announce the advent of something new and better to eat. There are more kinds of foods for more kinds of tastes and mental appetites than there ever were before. Magic cereals, mystic oils and sunburned cow's milk are a few of the recent arrivals. And with this fanfare of the food promoters, we hear the menacing rumbling and thumping of the tomtoms of the food faddists.

If we apply a critical but commonplace analysis to the subject of food, we find that nature supplied the essential elements in milk, eggs, vegetables, grains, fish, meat and fruit. Antiquity had all these, and we have no more than these today. Choice, fancy, food refining, whims of cooking, vagaries of food balance, and hybridity in agriculture have modified our dietary habits somewhat, but we are, in reality, eating nature's primary foods. Junket is milk; custards are eggs; cookies are grains; prunes are fruit; and so on down the list. True enough, so-called accessory foodstuffs, or vitamins, have been added (replaced is a more accurate word), but that is because civilization blue-penciled nature's original menu.

Stripped of its trimmings, the complex ration of modern man is no more than a combination of primary foods; and if that is so, and if nutritional health is merely a matter of food intake, we must push our conclusion farther, and believe that we have not learned how to use what nature gave us since we still have

osteoporosis in a multitude of forms.

The balanced diet was constructed upon the following basis of information: Food is a combination of nutritive materials of the same composition as the chemical structure of the body, namely, carbohydrate, protein, fat, salt, water and vitamins. Food is required by the body for the purpose of growth, maintenance of vital functions and repair of waste. One gram of protein furnishes 4 heat calories, 1 gm. of carbohydrate 4 calories, and 1 gm. of fat 9 calories. From birth to 5 years, a child requires from 40 to 50 calories per pound of body weight; from 6 to 14 years, from 25 to 35 calories per pound. From 10 to 15 per cent of the total food should be represented by protein, from 60 to 75 per cent by carbohydrate, and the remaining heat calories by fat. The daily requirement of phosphorus is from 0.25 to 0.5 gm.; calcium from 0.5 to 1.0 gm.; iron, from 7 to 10 mg., and undetermined, although hypothetically minute, quantities of copper, magnesium and the chlorides and carbonates of sodium and potassium. Infants and young children require from 50 to 60 gm. of water per pound of body weight daily. Water forms from 80 to 90 per cent of appropriate food. Thirty grams of orange or tomato juice and 8 gm. of cod liver oil furnish adequate vitamins. Food should be clean, that is, free from pathogenic bacterial contamination. Food should be digestible and in proper amount.

Average breast milk in adequate amounts comes very close to fulfilling the requirements of the hypothetically ideal ration. Breast milk is deficient in iron and copper, although this lack may be compensated for a few months by the iron and copper stored in the liver of new-born infants. Unfortunately, the percentage of breast-fed babies is dwindling rapidly, and few babies that are fed breast milk exclusively go beyond the sixth month without nutritional anemia and osteoporosis in one form or another. In general, it may be said that supplementary foods become a necessity after the sixth month if a sufficient diet is to be maintained.

If we follow rules, it is a simple matter to arrange a balanced diet for a child of any age. For example, we suggest that a child 1 year old weighing 21 pounds requires approximately 1,000 calories of clean, readily digested food. Of the total 1,000 calories, protein should contribute from 100 to 150, carbohydrate from 600 to 750, and fat the remaining heat calories. One quart of milk furnishes, in addition to a large part of the protein, carbohydrate and fat, sufficient salts. One ounce of orange juice, 2 teaspoonfuls of cod liver oil and a cup of water complete the dietary. Unfortunately, there is a snag in this simple proposal. The road to nutritional health is not measured with a teaspoon; rules in dietetics are mere guideposts, indicating general directions for everyone alike.

If we concede that a child is an individual, and that no two individuals possess identical growth impulses, we acknowledge that our ideas of a standard optimum diet cannot be fixed. Moreover, we do not now know, nor is it likely that we shall soon learn, what constitutes normal bone growth in an individual child. Vitamins, for instance, and an increasing mass of phenomena included broadly under the term endocrinology, take us from the main highway of a standard diet to the complex side roads of mineral metabolism.

By referring to the individual child group, it is not hard to find a case in which delayed dentition is a prominent symptom. The diet has been theoretically balanced. Vitamins A, B, C and D have been emphasized; dicalcium phosphate has

been added, and, because he was an individual child, the development of teeth was not accelerated until a little iodine was added to stimulate action of the thyroid.

What I am trying to say to you is that we should not think of diet and bone development simply in terms of so much salts, protein and vitamins, and so many calories, but of the interplay of all factors in absorption, distribution, and utilization. Considered from this viewpoint, the apparent inconsistencies in the balanced diet become at least less disconcerting.

In definite conflict with adherents of the balanced diet is that group of investigators which asserts that the standard dietary is greatly deficient in lime salts; that 98 per cent of calcium in the body is found in bone tissue, and that, therefore, normal bone development requires more calcium than the average diet provides. Stated thus, the opposition appears to be complete. But let us go into the matter a little farther.

The chemical elements necessary to the structural development of teeth are largely those required in the growth of the entire skeletal structure. The most important of these elements appear to be the lime salts, calcium and phosphorus. The deciduous teeth are almost completely calcified at birth; the permanent teeth begin to calcify at birth, and the process continues up to the eighteenth year.

The growth of bone is more rapid during the first year than at any other period in life. Infants triple their weight in the first twelve months and grow 7 to 12 inches in height. The rate lessens rapidly after the first year, and, for a span of years, a more gradual development is maintained, until the preadolescent years, when the growth impulses accelerate bone development through adolescence.

During the periods of most rapid growth, it is obvious that adequate amounts of calcium and phosphorus must be supplied, mobilized, carried to skeletal tissues and retained for normal growth and structure. If we place sole dependence on food for the provision of these salts, it is equally obvious that the ingested food must contain sufficient amounts of calcium and phosphorus in a form readily assimilable.

In the embryo, the quality and extent of calcification of the deciduous teeth is dependent on maternal metabolism. If the prospective mother's diet is deficient in mineral salts, there occurs a decalcification of her bone tissues to compensate the deficiency in her dietary. Withdrawal of large amounts of salts from her tissues cannot be thought of as the desirable process, but even if some decalcification is normal, there is a limit to this withdrawal. It is hardly necessary to add that we are looking to obstetricians for data concerning a sufficient maternal diet. At present, the standards of maternal diet are largely empiric.

The new-born child receiving breast milk, and infants on milk formulas, obtain an abundance of calcium and of phosphorus. In fact, there is usually an excess supply. Calcium and phosphorus from breast milk are more readily retained than that from cow's milk, but this difference is of little importance since there is an excess in the latter which is merely excreted. Quantitatively and qualitatively, the high milk feedings of the first year supply a generous salt ration.

Here the question might be asked: why do infants receiving adequate amounts of easily assimilable mineral salts develop osteoporosis? In the individual child group, we find an answer in a mineral metabolism gone awry. Deposition and retention of calcium and phosphorus depend not alone on supply and absorption, but on the meshing of many factors

not all of which are thoroughly understood. Insufficient sunlight, an inadequate amount of vitamin D in the diet, an excess of fats, an improper ratio of retained calcium and phosphorus, dysfunctioning parathyroids, chronic infection, any one of these, or something else not so evident, may be to blame. It is somewhat easier to control diet than to control sunlight. Many facts are known concerning mineral metabolism, but the recentness of this branch of study suggests that there is much which we do not know.

The dietary of older children, and more especially the mixed meal of preadolescent years, is relatively somewhat lower in calcium and phosphorus content. Indeed, when we examine the elaborate data proposing definite optimal amounts of calcium and phosphorus, and then refer to numerous compilations and tables giving exact amounts of these salts in ordinary foodstuffs, we entertain some doubt that sufficient quantities of these salts are available to supply optimal amounts in the average dietary of older children. Not all of these calculations emanate from theorists: clinical data support the contention that optimal amounts of calcium and phosphorus are necessary to normal bone development when optimal amounts are calculated and interpreted for the individual child. Clinicians assert that while the diet of the average child of 10 years should contain from 0.75 to 1.0 gm. of calcium and from 0.25 to 0.5 gm. of phosphorus to assure a blood calcium concentration of 10 mg. and a phosphorus concentration of 5 mg., the individual child at times may need no more than 0.5 gm. of calcium and 0.2 gm. of phosphorus in his daily ration to have normal blood concentration of these salts. When the intake of calcium and phosphorus is deficient, a child will retain an increased amount of the needed element until normal balance is restored. A retention of 40 mg. of calcium and 25 mg. of phosphorus per kilogram of body weight is normal, but retention in these amounts will frequently occur even though the food intake is low in calcium and phosphorus. This is strikingly demonstrated in children convalescing from a severe illness in the course of which the blood has been depleted of calcium and phosphorus. Furthermore, clinicians maintain that normal blood concentration of calcium and phosphorus is no guarantee against osteoporosis. For example, the postural osteoporotic flattening of the occiput bone, so commonly seen by pediatricians in infants, is not always a rachitic phenonemon, as Alfred Hess demonstrated in normal roentgenographic plates and normal concentration of calcium and phosphorus of the blood. Parenthetically, is it going too far afield to refer to the possibility that general cranial bone asymmetry of nonrachitic osteoporosis, involving, as it usually does, the dental arches, may be an etiologic factor when malocclusion occurs in these children?

The apparent clinical fact in regard to the dietary of the majority of children seems to be that unless mineral salts are included in the diet, and adequate amounts of these salts are deposited and retained by bone structures, not only are poorly calcified teeth likely to result but also, and by the same process, hypoplasia in some degree of other parts of the skeletal structure. In the individual child's group, it is apparent clinically that metabolism takes care of a deficient intake of mineral salts by increasing the retention of these salts, or metabolism does the reverse, even though the supply of calcium and phosphorus is optimal, and we have insufficiently calcified teeth and bowlegs. Capricious, this thing called metabolism!

An optimal amount of calcium and

phosphorus in the dietary of growing children is certainly a wise provision for the prevention of hypoplasia whether the child is one of the majority or one of the individual child group, and our dietaries are arranged to cover this prophylactic measure. Unfortunately, the problem is not so simple as this. Metabolism has complex interests in the economy of the body, and it seems not out of order to wonder about copper, magnesium and potassium, and about protein and fat in bone development. It would be interesting, if difficult, to do a little research to determine how many in every hundred children have bone hypoplasia, not because of an inadequate supply of mineral salts, but because of, let us say, abnormal protein metabolism.

Hart and Steenbock and their associates have demonstrated that a sufficiency of iron salts alone is unable to bring about hemoglobin regeneration in the nutritional anemia induced by exclusive milk feeding and that the addition of copper always causes the increase of hemoglobin. Perhaps we shall have information some day that another salt influences the retention of calcium and phosphorus, as vitamin D is now known to accelerate the deposition of these salts in bone.

Sweet milk, buttermilk, and cheese are excellent sources of calcium and phosphorus. Cauliflower, oatmeal, string beans, carrots, cabbage, oranges and whole wheat bread contain small amounts of lime salts. Many foods commonly considered good sources of calcium are, in reality, poor in this element. To provide the optimal quotient of calcium from eggs alone, for example, would require that the child consume about two dozen eggs daily.

Most children dislike buttermilk and cheese, and frequently there are substantial reasons for not giving a child a quart of sweet milk daily (the amount necessary to provide 0.75 gm. of calcium). The iron content of milk is so low that a nutritional anemia is common unless other foods compensate for this deficiency. Furthermore, it is desirable that a variety of proteins and carbohydrates not contained in milk be supplied in the dietary of the growing child. The skeletal structures are but one fifth of the body, and normal nutrition requires some thought of the other four-fifths.

If the child drinking a quart of milk daily maintains as good an appetite for other foods, the milk drinking is to be encouraged; but when the appetite for mixed foods begins to lag, it is well to reduce the amount of milk allowed and rely on the hunger reflex to restore proper balance. Every family physician has a few homemade tricks in his bag of clinical experience. My favorite is withdrawing milk entirely from the diet of the child with a finicky appetite. Not until normal appetite returns is milk again allowed. It is surprising how well this works.

SUMMARY

My observations are that (1) primary foodstuffs contain adequate amounts of all chemical elements essential to normal bone development; (2) insufficient sunlight, and changes in primary foods brought about through cooking and refining, necessitate replacing vitamins in the diet; (3) vitamins, and trade-marked goods with alluring wrappings and descriptive booklets passed over an enormous commercial counter into the hands of a credulous public, are not the panacea that we wish they were; (4) there is no ideal ration for every child alike; (5) further research is likely to teach us how to make nature's primary foods self-sufficient; (6) abnormalities of bone structure and development in the individual child group are more a matter of metab-

olism than of food intake, and (7) the individual child will eat ample amounts of, for him, the right kind of food as long as he is given the opportunity.

HISTOPATHOLOGY OF THE DENTIN AND ENAMEL*

By THEODORE BEUST, D.D.S., Louisville, Ky.

WHEN considering the dictionary interpretation of the term "pathology" in its application to the hard structures of the teeth, one is reminded that many doubt the existence of powers that *could* enable these tissues to effect biologic changes within their substance. Structural and functional changes can occur only in structures possessing the attribute of reactivity. A piece of granite is not thus endowed; nor is a piece of lead or silver. They lack the vital elements.

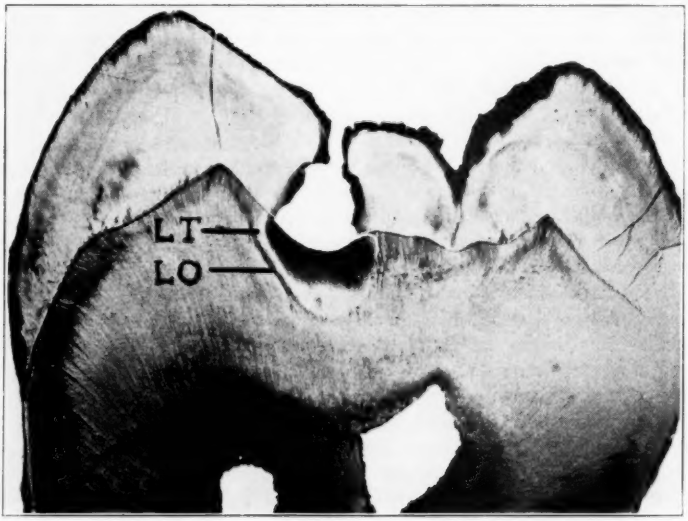

Fig. 1.—Caries. *LT*, translucent zone; *LO*, lateral opaque chromophilic zone.

The hard substances of the teeth, according to many authors, are therefore not eligible for classification with tissues capable of reacting, in a pathologic sense, to irritation. G. V. Black, Arthur

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*Work supported in part by a grant from the Research Commission of the American Dental Association.

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 9, 1933.

Hopewell-Smith and J. Leon Williams have regarded calcified tooth substance as inert and unchangeable. This opinion has been reflected by the large majority of dental practitioners, but this point of view is open to grave objection.

Fig. 2.—Sclerosis following abrasion of a lower incisor, stained after treatment of tooth with ether and alcohol. (Halved tooth.)

Nothwithstanding much excellent work and the many exhaustive arguments supporting the two sides of this question, recent histologists, in view of the many convincing observations indicating the occurrence of posteruptive anabolic processes in the tooth's calcified parts, now incline more and more to the view that reactions occur in both the dentin and the enamel. I call attention to the possibility of injecting the enamel of recently erupted teeth by causing stains applied to the pulp cavity[1] to follow the natural channels leading from the pulp into the

Fig. 3.—Abraded sclerosed cuspid, halved tooth, stained for one month in strong alcoholic fuchsin. After staining, the palatal enamel was removed. Repeated exposure to the stain failed to affect the opened tubules.

enamel tissue. This experiment has been corroborated by Mummery,[2] C. F. Bö-

1. Beust, T. B.: D. Cosmos, 54:659 (June) 1912.

2. Mummery, J. H.: Brit. D. J., 43:607 (July) 1922.

decker,[3] Smreker[4] and Fish.[5] The mere comparison of results attained in young teeth with like attempts made later in life, when such communications no longer exist, suffices to prove that such changes occur.

This is not all: In the dentin, where the tubules of the recently erupted tooth conduct fluids with eagerness and communicate these to the dentinal ground substance, similar experiments undertaken with the teeth of the aged reveal that this conductivity has been reduced to nil,

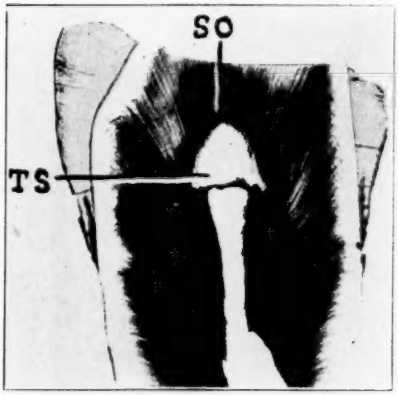

Fig. 4.—Abraded bicuspid with opaque sclerosis of tubules involved. A plug of secondary dentin covers the tubules. Observation of such specimens by transmitted light creates the erroneous impression of "dead" tubules containing necrosed fibrils. (Transmitted light photograph, stained specimen.) *SO,* sclerosed opaque dentin, *TS,* transparent secondary dentin.

or is limited to isolated well defined regions or exists only in the younger dentin in the immediate vicinity of the pulp.

The changes here described gave rise to my concept of tooth maturation,[6] a term and concept that has since been adopted by C. F. Bödecker.[7] Tooth maturation, as the name implies, embodies the final changes occurring as a result of pulp cavity obliteration by dentin deposition, resulting in loss of metabolic activity in the enamel, in the dentinal fibril, in the matrix substance, in the tubules and finally in the pulp.

The demonstration of the changes mentioned leaves no doubt that the calci-

Fig. 5.—Reflected light photograph of specimen shown in Figure 4. The zone *SO* is revealed as chromophobic sclerosed dentin.

fied tooth structures change during life and that as long as vital pulp is present, they are biologically functioning parts of the organism. During the life of the pulp, the tooth, in common with other tissues, may react to trauma, physiologic stress, continued irritation and possibly nutritional disturbance.

3. Bödecker, C. F.: Permeability of Enamel in Relation to Stains, J.A.D.A., 10:60 (Jan.) 1923.

4. Smreker, E.: Ztschr. f. Stomatol., 24:460, 1926.

5. Fish, E. W.: Circulation of Lymph in Dentin and Enamel, 14:804 (May) 1927.

6. Beust, T. B.: Reactions of Dentinal Fibril to External Irritation, J.A.D.A., 18:1060 (June) 1931; J. D. Res., 11:267 (April) 1931; Posteruptive Changes in Maturation of Teeth, J.A.D.A., 18:2186 (Nov.) 1931; J. D. Res., 11:619 (Aug.) 1931.

7. Bödecker, C. F., and Applebaum, Edmund: D. Cosmos, 74:1177 (Dec.) 1932.

CARIES

In order that newer phases of reactions may be presented, the known facts of tooth destruction by caries as first laid down by Leber and Rottenstein[8] and later modified by W. D. Miller and is of interest to note that the dark fibers in question, which were first remarked on by W. D. Miller, are chromophilic. (Fig. 1.) The conclusion arrived at in my papers was that this area represents a hyperchromophilic imflammatory zone

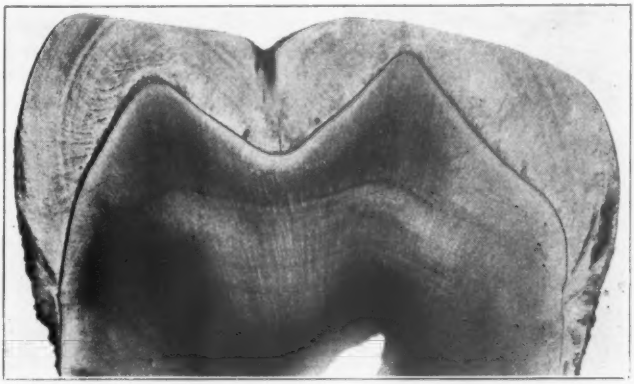

Fig. 6.—Formation of "developmental" lines by aggregations of clouded tissue into lines.

others will be omitted. For this part of the work, reference is made to the excellent work of Kronfeld.[9] The question of formation of visible fat in the tubules surrounding the transparent zone demands some comment. Kronfeld, quotting Weber, Euler, Meyer and Liesegang, implies that fat globules appear in the tubules adjacent to the translucent zone. Fat soluble stains were used in the determination of the presence of fat in this case. The area involved was discussed at length in two of my recent papers. In the first,[10] the pulpal and the terminal ends of the tubules and their relation to the translucent zone were described. It

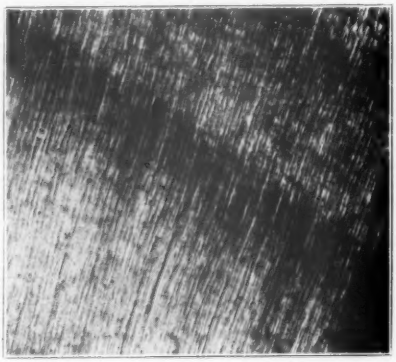

Fig. 7.—Enlarged section of most conspicuous line shown in Figure 6.

which marks the transition of the normal tubule into the translucent form of dentin. This conclusion appears justified in view of the fact that both zones may appear under early caries, and that they thereafter keep pace with the advance of

8. Leber and Rottenstein: Untersuchung ueber die Karies der Zaehne, Berlin: Hirschfeld, 1860.

9. Kronfeld, Rudolf: Histopathology of Teeth, Philadelphia: Lea & Febiger, 1933.

10. Beust, T. B.: Reaction of Dentin to Advancing Caries, J.A.D.A., 20:631 (April) 1933.

the lesion, both laterally and centripetally, until the caries has reached extreme dimensions.

As I showed in an earlier paper[11] that fat soluble Sudan III colors any tubules that are susceptible to fuchsin stain, the reaction noted in this hyperchromophilic zone does not necessarily denote the presence of fat. The question of a fat content of these tubules is of current interest, as C. F. Bödecker regards fat as the potency of Dr. Bödecker's supposed fat deposits as barriers to fluids, two photographs are offered by him in rebuttal.[12] In these, he claims to have succeeded in dissipating the opacity of the tubules by boiling in xylene. As he has recently expressed doubt concerning his own experiment,[13] and as the insignificant differences in opacity may be attributable to differences in the substage illumination and other conditions incident to the heating

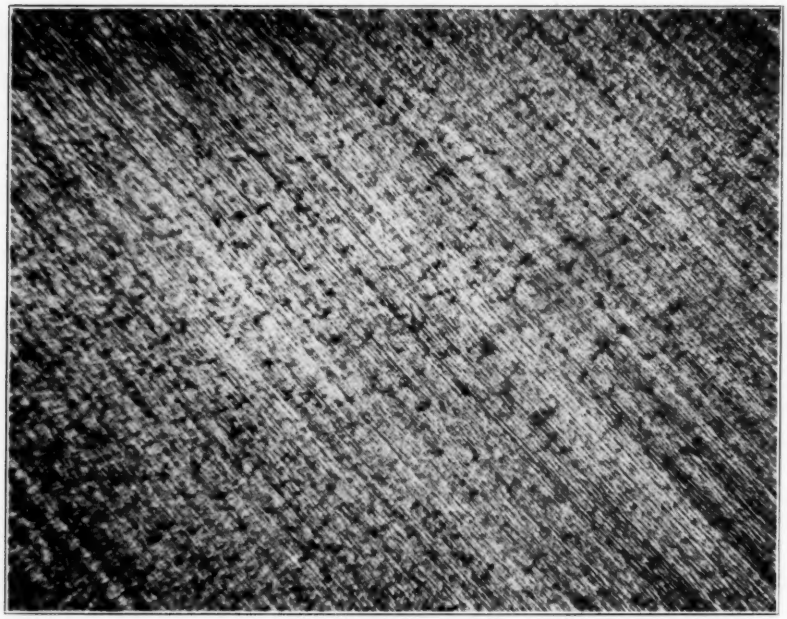

Fig. 8.—Diffuse dappling of dentin.

agent that prevents permeation of the tubules by fluids. The presence of fat in this hyperpermeable zone therefore would add another paradox to the much confused state of our knowledge of the reactions to caries. As I doubted the of the specimen, the matter demands further attention.

SCLEROSIS OF THE DENTIN

Sclerosis of the dentin, particularly of

11. Beust, T. B.: D. Cosmos, 74:541 (June) 1932.

12. Bödecker, C. F.: D. Cosmos, 75:21 (Jan.) 1933 (Figs. 14-15).

13. Footnote 12 (Footnote 15).

the zones found under abrasion and caries, has been given much consideration by dental authors during the past two years. The contention made in my paper read at Denver in 1930[14] and in a paper presented before the Chicago section of the International Association for Dental Research[15] that irritated dentin ordinarily became sclerosed met with expressions of skepticism. Today, both the view and the term used to express the condition are regarded more favorably. The fact that a sclerosis occurs can no longer be doubted, yet the actual condition of the affected tissue still constitutes a problem.

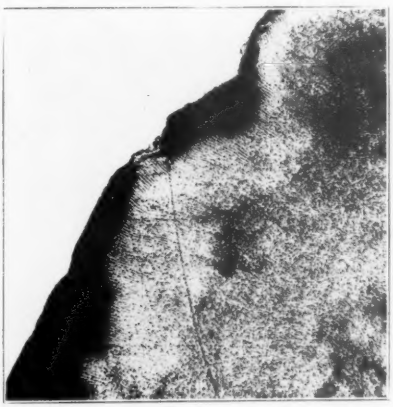

Fig. 9.—Superficial "hypoplastic" enamel lesion, stained.

My published experiments proved that this tissue is impermeable to fluids. C. F. Bödecker has claimed that abraded areas analogous to those shown in Figure 2 are permeable from without, but that a calcified plug of secondary dentin seals the pulpal ends of the tubules. E. W. Fish has also held that abraded fibrils die down to the pulp, and that these fibrils undergo necrosis and are sealed by depositions laid over their central ends by the pulp. As the physical nature of dentin containing necrosed fibrils must be conducive to permeation by alcoholic fuchsin stain, the matter was given further attention. Careful tests have convinced me that the pulpal seal of secondary dentin shown by authors who regard it as a barrier does not ordinarily cover open tubules, but that the tubules are impermeable throughout their length. (Fig. 3.) The pulpal seal must therefore be regarded as a reinforcement of dentin that has already undergone sclerosis. (Figs. 4 and 5.)

14. Footnote 6, first reference.

15. Footnote 6, second reference.

DEVELOPMENTAL LINES

In the discussion of deviations from the normal, we are confronted with the difficulty of discerning between the physiologic or anatomic and the pathologic. Judging normality by the frequency of occurrence would be futile, as some conditions that are supposed to be evidence of maldevelopment are universally represented in teeth. I call attention to the interglobular spaces and the tufts. Because of our inability to differentiate accurately, it would be pertinent to include in this paper any condition that is being regarded as a hypoplasia or defect.

The alinement of interglobular spaces into rows roughly following the contours of the dentin, called the lines of Czermak, are adequately known. Other lines pursuing the same course, caused by sudden deflections in the course of the tubules, are known as Owen's lines. I wish to report on a third variety of line caused by differences in the calcification of the dentin. Rows of poorly calcified areas distinct from, but evidently related in origin to, the interglobular spaces are left in the matrix as dentin development proceeds. (Figs. 6 and 7.) The individual spots are morphologically identical with those causing the dappling of the dentin

found associated with caries. Here, the dappling becomes intensified as caries progresses, as if the tissue were in a hyperemic state. Occasionally, teeth are met with that display this dappling throughout the dentin of the crown portion. (Fig. 8.) As the irregular spots causing the dappling appearance are susceptible to staining, it is evident that they represent poorly calcified areas in the matrix.

ENAMEL

Experienced practitioners of dentistry are familiar with the occurrence of variations in the translucency of the enamel covering the teeth. The normal luster of the enamel gives place to modifications that indicate changes in its physical or chemical structure. One of these anomalies manifests itself in the occurrence of spots or even of large areas that may cover a whole tooth surface and that appear "chalky" and have the appearance of having been decalcified by an acid. One or many teeth may be affected. The areas are usually white, or may vary from a cream color through various hues of reddish brown to deep brown. A loss of surface continuity is not in evidence. When subjected to protracted exposure to alcoholic aniline stains, these areas are found to be permeable. (Fig. 9.) This differentiates them from the normal enamel of adult teeth, which fails to stain. Dentists, and also certain histologists[9] regard these affected areas as caries. In fact, some of these areas may be caries; yet it is also well established that teeth so affected are not necessarily carious and furthermore that they may remain free from caries throughout the life of the subject. Lesions resembling these are exhibited on the teeth of the lower animals, the pig being a common example. Microscopic examination of the

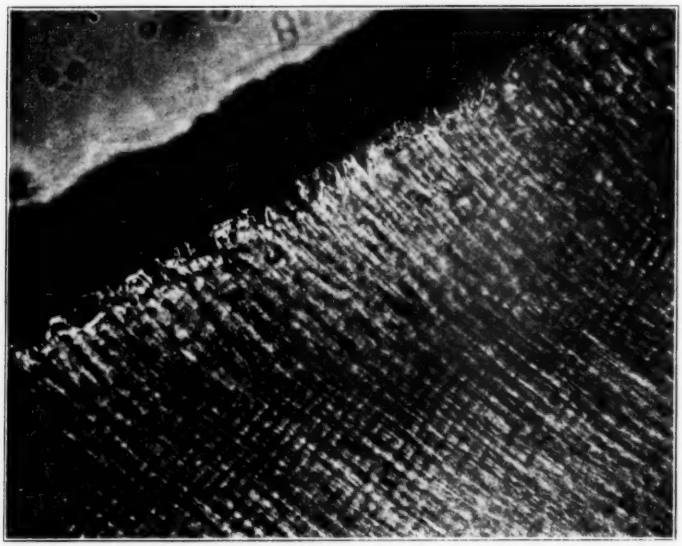

Fig. 10.—Superficial enamel lesion showing clouding of rod substance and surrounded by increased visibility of striations.

unstained specimens discloses the same opacity that is perceptible to the unaided eye. The striations, "beading," of the rods is seen to be exaggerated and the whole tissue appears clouded. (Fig. 10.) In the stained specimens, the affected areas are diffusely stained, the substance of the rod itself being colored. Rarely, the interprismatic substance appears to

Fig. 11.—Extensive deep-seated underdevelopment of enamel, stained. The fissure caries is independent of the lesion.

Fig. 12.—Deep-seated underdevelopment of enamel, stained. The progress of the fissure caries does not appear to be influenced by it. (Reflected light photograph.)

be missing and the rods appear intact. The enamel is affected to varying depths.

It may be said in support of the assumption that the enamel under discussion has been decalcified by acids formed under colonies of aciduric bacteria that my experiments conducted in 1924[16] show that enamel, especially the enamel

Fig. 13.—Worn intact tooth with multiple deep-seated areas of hypoplasia, stained. (Reflected light photograph.)

Fig. 14.—Diagonal sections of stained tuft "fibrils" proving that rods are intact.

16. Beust, T. B.: Contribution to Etiology of Mottled Enamel, J.A.D.A., 12:1059 (Sept.) 1925.

of recently erupted teeth, when treated by very dilute acids, can be decomposed to various depths without the loss of surface continuity. We have in these lesions a morphologic parallel to the affliction known as "mottled enamel." Accepting normal we would have a clue to the causes of this anomaly.

Acknowledging the difficulties of interpretation presented by the superficial lesion, above described, a problem of far greater complexity is presented by the occurrence of similar changes in the deeper regions of the enamel. This form manifests itself as changes in hue to lighter or darker involving small or large areas, or

Fig. 15.—Close-up of stain conducting capillary spaces or fibrils, showing intact rods.

Fig. 16.—Parallel tuft rows seen from side in tangential slice from molar.

the as yet unsubstantiated hypothesis of mottled enamel etiology, which assumes a preeruptive substitution of foreign ingredients, in this case fluorine, for the

even whole teeth. These differ in appearance from the superficial form in that the outer region of the enamel structure is normal, the teeth exhibiting in this case the usual luster. When subjected to my test for permeability,[15] it can be observed that the outer region of the enamel is normal, the inner part of the moved from outside influences. (Fig. 13.) The etiologic significance of caries, or an attack by acids, is here entirely excluded. The substitution theory, mentioned in connection with the superficial form, also loses significance as substitutions logically follow developmental laws, the lesions in question occurring quite erratically. For practical purposes, these lesions may be termed hypoplasia.

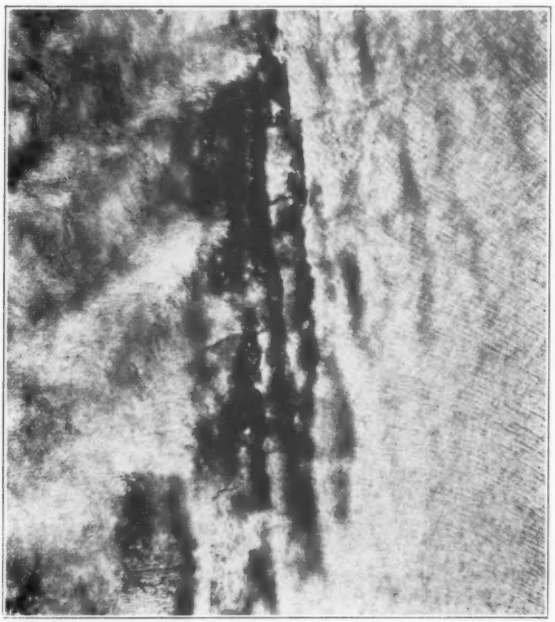

Fig. 17.—Group at lower left of Figure 16, magnified.

tissue displaying the anomalous condition seen in the superficial lesion. The enamel which answers this description (Figs. 11-12) has not been influenced by breaks in surface continuity lying near the plane from which the section was made. In fact, the lesion may be found in serial sections made from intact teeth. It frequently appears in isolated spots lying in the depth of the enamel, re-

TUFTS

Other anomalies of the enamel, if the reports of many histologists are given credence, are the enamel tufts. Tufts have ordinarily been referred to as defects. Nothwithstanding the publication of several investigations discussing the

morphology, distribution and nature of tufts,[17] authors continue to regard them as defects. Orban[18] regards them as poorly calcified enamel rods and cementing substance. Kronfeld, in his new work, [19] expresses the same view. Some new editions of textbooks even omit to mention these conspicuous structures. In 1928, L. E. Van Kirk[20] published a laborious investigation picturing enamel "defects" which were described as "granulated rods." These so-called defects are nothing more than side views of tuft rows. There can be no doubt that the interpretations placed on the tufts by these authors are not borne out by careful study. In my work on the tufts, I insisted as early as 1912 and on various later occasions that the tuft "fibrils" in early youth were capillary spaces partly surrounding the enamel rods. They occur in the space usually occupied by the interprismatic substance. If tufts consisted of poorly calcified prisms, the

Fig. 18.—Sections of tuft rows springing from dentin and out in enamel tissue, believed by some to be defective enamel rods.

17. Beust, T. B.: Physiologic Changes in Enamel After Tooth Eruption, J.A.D.A., 11:396 (May) 1924 (Figs. 2-4); Capillaries of Enamel and Relation to Mottled Teeth, ibid., 13:980 (July) 1926; Morphology and Biology of Enamel Tufts; Relation to Caries, ibid., 19:488 (July) 1932; J. D. Res., 12:601 (Aug.) 1932.

18. Orban, Balint: Histology and Embryology of Teeth, Philadelphia: P. Blakiston's Son and Co., 1929, p. 44.

19. Footnote 9, p. 25.

20. Van Kirk, L. E.: Variations in Structure of Human Enamel and Dentin, J.A.D.A., 15:1270 (July) 1928.

stained tufts in cross-section would not be nearly flat or half-moon shaped, but would resemble a cross-section of the enamel rod. (Figs. 14-15.) This is not the case.[21] Another fact that militates against an assumption of defects is the observation that the tuft elements regularly become occluded by calcific or horny deposition as the subject increases in age and thus that by the time maturity is reached, the tufts no longer conduct stains.

The morphology of these structures is not yet generally understood. I showed in 1923 that tufts were arranged in vertical parallel rows.[22] Discussion of these would not be indicated here, but I wish to add photomicrographs (Figs. 16-18) showing how short segments of parallel rows can simulate enamel defects in longitudinal sections of teeth. (Fig. 18.) Views of this kind often result when molars are sectioned vertically in such a manner that the cut passes diagonally across the crown from corner to corner. In this way, tangential sections are often secured which present views of the rows from the side.

These remarks on the supposedly defective or hypoplastic tuft fibrils, although presenting a negative viewpoint, nevertheless constitute a contribution to the histopathology of the enamel, as the elimination of this item from the list of known defects narrows the field considerably.

129 East Broadway.

21. Footnote 17, third reference.

22. Footnote 17, first reference.

A SECOND SURVEY OF DENTAL IMPRESSION COMPOUNDS AND OF INLAY CASTING WAXES*

By GEORGE C. PAFFENBARGER,† D.D.S., and W. T. SWEENEY,† A.B.,
Washington, D. C.

PURSUANT to the policy[1] of the Research Commission, the research associates purchased on the open market five brands of impression compound and six brands of inlay wax. All of these materials either had a guarantee on the package stating that they complied with the specifications[2] of the American Dental Association or were formally certified to the Research Commission.

These products were then tested to determine whether they conformed to the Association's specifications.[2] Tables 1, 2, 3 and 4 are based upon the results of these tests.

Duplicate tests were carried through

*Publication authorized by the Executive Board of the Research Commission of the American Dental Association.

†Research associate for the American Dental Association at the National Bureau of Standards.

1. Dental Research Fellowship at National Bureau of Standards—Research Commission, J.A.D.A., 20:1040 (June) 1933.

2. Taylor, N. O.; Paffenbarger, G. C.; Sweeney, W. T.: Specification for Inlay Casting Wax, J.A.D.A., 18:40 (Jan.) 1931. Taylor, N. O.; Sweeney, W. T.; Paffenbarger, G. C.: Specification for Dental Impression Compound, J.A.D.A., 18:53 (Jan.) 1931.

TABLE 1.—CERTIFIED IMPRESSION COMPOUNDS WHICH MET A.D.A. SPECIFICATION NO. 3

Brand	Manufacturer
Dresch	The Ransom & Randolph Co.
Kerr—Black	Detroit Dental Manufacturing Co.
Kerr—No. 3	Detroit Dental Manufacturing Co.
Kerr—Perfection	Detroit Dental Manufacturing Co.

TABLE 2.—IMPRESSION COMPOUNDS WHICH DID NOT MEET A.D.A. SPECIFICATION NO. 3

Brand	Manufacturer
Brewster*	E. R. S. Brewster

*The first sample was failed; the second sample passed. A communication from the manufacturer states that boxes with serial number of 5061 or above comply with the specification.

on all samples. When the sample failed to comply with the physical property requirements of the specification, additional tests in duplicate were conducted by another observer.

TABLE 3.—CERTIFIED INLAY WAXES WHICH MET A.D.A. SPECIFICATION NO. 4

Brand	Manufacturer
Brewster Blue	E. R. S. Brewster
Kerr—Blue (Hard)	Detroit Dental Mfg. Co.
Maves	The Heidbrink Co.
Peck's Blue	A. E. Peck Mfg. Co.
Peck's Purple	A. E. Peck Mfg. Co.

TABLE 4.—INLAY WAXES WHICH DID NOT MEET A.D.A. SPECIFICATION NO. 4

Brand	Manufacturer
Ransom & Randolph Standard Blue—Hard*	The Ransom & Randolph Co.

*All samples failed to comply with the specification requirements.

SPECIFICATIONS AND CERTIFICATIONS FOR DENTAL MATERIALS*

By GEORGE C. PAFFENBARGER,† D.D.S., and W. T. SWEENEY,† A.B.,
Washington, D. C.

ONE of the chief aims of the Dental Research program jointly conducted by the National Bureau of Standards and the American Dental Association is the drawing up of satisfactory standards or specifications for dental materials. These specifications are based upon the opinions of manufacturers, dentists and dental schools and a survey of the physical properties of the currently used materials.

Seven tentative specifications for various types of dental materials were developed prior to 1933, including amalgam alloy, inlay casting investment, impression compound, inlay wax, inlay casting golds, dental mercury and wrought gold wire. An eighth tentative specification covering the zinc phosphate cements is now being prepared.

REVISION OF AMALGAM ALLOY SPECIFICATION

All of the seven specifications which have been adopted by the American Den-

*A report to the Research Commission of the American Dental Association.

*Publication authorized by the Executive Board of the Research Commission of the American Dental Association.

†Research associate for the American Dental Association at the National Bureau of Standards.

tal Association are tentative. It is contemplated that changes will be made in any of the requirements if the available materials show marked general improvement, or if, through experience, the tentative specifications are found to be too exacting or too lax.

Pursuant to the Research Commission's policy of maintaining these specifications on as high a level as is practicable both from a user's and manufacturer's point of view, the amalgam alloy specification was modified on Jan. 1, 1934.

Many valuable suggestions were received from both the consumers and the makers of amalgam alloys. These suggestions were all examined critically and given due consideration before any values or test methods in the former specification were altered. Any change recommended had to be in agreement with the three

TABLE 1.—A.D.A. SPECIFICATION NO. 1 FOR DENTAL AMALGAM ALLOYS

Alloy	Manufacturer
Argentum	Hammond Dental Mfg. Co.
Aristaloy	Baker & Co., Inc.
Banner	Goldsmith Bros. Smelt. & Ref. Co.
Brewster	E. R. S. Brewster
Certified	Lee S. Smith & Son Mfg. Co.
Coe	Coe Laboratories, Inc.
Dee	Thos J. Dee & Co.
Excel	Daniels Dental Alloy Co.
Keystone	Lee S. Smith & Sons Mfg. Co.
Minimax Nos. 172, 173, 174, 177, 178, 180, 181, 183, 161	The Minimax Co.
Minimax White Gold and Platinum	The Minimax Co.
Mission No. 5 and No. 6	San Diego Smelting and Refining Co.
Modeloy (Quick Setting)	Crescent Dental Mfg. Co.
Odontographic "Improved"	Odontographic Mfg. Co.
P. D. Q.	Patterson-Hettinger Co.
Pearlol	Wildberg Bros. Smelting and Refining Co.
Preferd	Michigan Refining Works
Royal—Special First Setting	Garhart Dental Specialty Co.
Silverloy	Crescent Dental Mfg. Co.
67 Silver Alloy	Research Products Corporation
Specific Alloy	Research Products Corporation
Speyer	Speyer Smelting and Refining Co.
S—C	Stratford-Cookson Co.
True Dentalloy (Filings)	S. S. White Dental Mfg. Co.
True Dentalloy (Cut A)	S. S. White Dental Mfg. Co.
Twentieth Century	The L. D. Caulk Co.
White Beauty	Lang Dental Mfg. Co.

TABLE 2.—A.D.A. SPECIFICATION NO. 2 FOR INLAY CASTING INVESTMENTS*

Investment	Manufacturer
Coecal Inlay	Coe Laboratories, Inc.
Coecal Universal	Coe Laboratories, Inc.
Kerr Cristobalite-Inlay	Detroit Dental Mfg. Co.
Kerr Cristobalite-Model	Detroit Dental Mfg. Co.
Kerr No. 3	Detroit Dental Mfg. Co.
Ransom and Randolph Gray	The Ransom & Randolph Co.
Ransom and Randolph Green	The Ransom and Randolph Co.
Ransom and Randolph X-45	The Ransom and Randolph Co.
S. S. White Inlay No. 20	S. S. White Dental Mfg. Co.

*J.A.D.A., December, 1930.

following considerations: 1. The dentist wishes the best material that can be secured. 2. The tolerances must be sufficient to allow for unavoidable variations in manufacturing processes. 3. Simplification of the tests or test methods should be made whenever possible.

AMERICAN DENTAL ASSOCIATION
SPECIFICATION NO. 1 FOR
DENTAL AMALGAM ALLOYS
(First Revision, Jan. 1, 1934)

I *Types.*—1. This specification is for the so-called "silver" amalgam alloys which are to be used for restorations in the mouth.

2. The alloy may be furnished as:
Type A. Filings
Type B. Shavings

II *Material.*—The comminuted alloy shall be free of foreign materials and shall be uniform and the amalgamated alloy shall not produce excessive blackening of the hand or white paper when rubbed against the hand or paper.

III *General Requirements.*—Amalgam alloys shall possess the following features, known as satisfactory working qualities:

1. Thorough amalgamation in three minutes.

2. Absence of granular or sandy consistency when amalgamated.

3. Susceptibility to carving for at least fifteen minutes after amalgamation.

4. Susceptibility to receiving and retaining a polish twenty-four hours after amalgamation.

IV *Detail Requirements.*—1. Chemical composition shall be within the following limits:

Silver, 65 per cent minimum
Copper, 6 per cent maximum
Zinc, 2 per cent maximum
Tin, 25 per cent minimum

Gold and platinum will not be regarded as foreign materials.

2. Flow. Specimens subjected to a constant pressure of 250 kg. per square centimeter (approximately 3,550 pounds per square inch) shall not show more than 4 per cent flow (i.e., more than 4 per cent shortening in length of specimen) in a period of twenty-four hours.

3. Setting changes. Twenty-four hours after amalgamation the length shall have increased between 3 and 13 microns per centimeter.

V *Methods of Sampling and Tests.*—The test specimens shall be made according to the published directions which shall accompany each package. These directions shall not require complicated equipment and shall be in harmony with recognized dental practice. The following details shall be included in these directions: ratio of alloy to mercury, type of mortar and pestle, whether the alloy and mercury shall be stirred or ground, mixing time, mixing speed (revolutions of pestle or number of times amalgam is spread out and rolled up in the hand, when and how the excess mercury shall be expressed and the method

TABLE 3.—A.D.A. SPECIFICATION NO. 3 FOR IMPRESSION COMPOUNDS*

Compound	Manufacturer
Brewster	E. R. S. Brewster
Dresch	The Ransom and Randolph Co.
Kerr Black	Detroit Dental Mfg. Co.
Kerr No. 3	Detroit Dental Mfg. Co.
Kerr Perfection	Detroit Dental Mfg. Co.
Kerr White	Detroit Dental Mfg. Co.

*J.A.D.A., January, 1931.

TABLE 4.—A.D.A. SPECIFICATION NO. 4 FOR INLAY CASTING WAX*

Wax	Manufacturer
Brewster	E. R. S. Brewster
Maves	The Heidbrink Co.
Kerr Blue—Hard	Detroit Dental Mfg. Co.
Peck's Blue	A. E. Peck Mfg. Co.
Peck's Purple	A. E. Peck Mfg. Co.

*J.A.D.A., January, 1931.

of packing. The following details relative to test methods shall be observed:

1. Flow. Specimens shall be cylinders 4 mm. in diameter and 8 mm. long. These shall be prepared by condensing the amalgam into a cavity of these dimensions in a rigid block using the technic given in the sheet of instructions accompanying the alloy.

The ends of the cylinders shall be surfaced plane at right angles to the axis. Tests shall be made at temperatures between 20 and 25 C. Three hours after condensing, the specimen shall be subjected to a constant pressure of 250 kg. per square centimeter (approximately 3,550 pounds per square inch).

2. Setting changes. Specimens shall be prepared by condensing into a cavity or matrix. These shall be removed as soon as condensation is completed and shall not be subject to restraint during the test. Measurements shall begin fifteen minutes after amalgamation (time spent in mulling and condens-

TABLE 5.—A.D.A. SPECIFICATION NO. 5 FOR INLAY CASTING GOLDS*

Alloy	Type	Manufacturer
Chilcast No. 1	A	Vernon Benshoff Co.
Chilcast No. 1-A	B	Vernon Benshoff Co.
Chilcast No. 2	C	Vernon Benshoff Co.
Chilcast No. 2-A	B and C	Vernon Benshoff Co.
Chilcast No. 3	C	Vernon Benshoff Co.
Coe 1	A and B	Coe Laboratories, Inc.
Coe 2	B and C	Coe Laboratories, Inc.
Coe 3	C	Coe Laboratories, Inc.
Deetwo Light	A	Thomas J. Dee & Co.
Deetwo	B	Thomas J. Dee & Co.
Deesix	C	Thomas J. Dee & Co.
Goldsmith Inlay No. 1	A	Goldsmith Bros. S. & R. Co.
Goldsmith Inlay No. 2—Medium	B	Goldsmith Bros. S. & R. Co.
Goldsmith Inlay No. 3—Hard	C	Goldsmith Bros. S. & R. Co.
K Inlay	A	Patterson-Hettinger Co.
Knapp No. 1	A	Patterson-Hettinger Co.
Knapp No. 2	B	Patterson-Hettinger Co.
Knapp No. 3	C	Patterson-Hettinger Co.
No. 1 Hard Inlay	B and C	Patterson-Hettinger Co.
No. 2 Cast Inlay	A	Patterson-Hettinger Co.
No. 9 Cast Gold	C	Patterson-Hettinger Co.
Research—Hard Cast—No. 5	C	Precious Metals Research Works
Research Inlay	C	Precious Metals Research Works
Spyco Hard	B	Spyco Smelting and Refining Co.
Spyco Soft	A	Spyco Smelting and Refining Co.
Spyco No. 6	C	Spyco Smelting and Refining Co.
S. S. White No. 2	A	S. S. White Dental Mfg. Co.
S. S. White No. 3	B	S. S. White Dental Mfg. Co.
S. S. White No. 13	C	S. S. White Dental Mfg. Co.
Stern No. 2847	C	I. Stern and Co.
Stern No. 3290	B	I. Stern and Co.
Stern No. 3337	B and C	I. Stern and Co.
Stern No. 3375	A	I. Stern and Co.
Stern No. 3441	C	I. Stern and Co.
Stern No. 3465	B and C	I. Stern and Co.
T	B	Patterson-Hettinger Co.
TT	C	Patterson-Hettinger Co.
Tinker No. 1	B	Spyco Smelting and Refining Co.
Tinker No. 1H	C	Spyco Smelting and Refining Co.
Tinker No. 2	C	Spyco Smelting and Refining Co.

*J.A.D.A., January, 1932.

ing to be included as a part of the fifteen minutes).

VI *Packing.*—1. The alloy shall be packed in moisture-resisting containers and in quantities of 1, 2 or 5 troy ounces.

2. Accurate and adequate instructions for proportioning and manipulation shall accompany each package.

3. Each package of alloy shall be marked with a serial number or a combination of letters and numbers which shall refer to the manufacturer's records for the particular lot or batch of alloy.

4. The date of manufacture (year and month) shall be indicated on the package as a separate item or as a part of the serial number.

5. Containers shall not be made, in whole or in part, of materials which will amalgamate readily with mercury.

VII *Notes.*—1. Manufacturers of amalgam alloys may indicate that their materials comply with this specification by (*a*) a statement on the package guaranteeing the material contained therein to meet the requirements of this specification, or (*b*) a statement as to the chemical and physical properties of the alloy.

2. The American Dental Association will not assume responsibility for, or guarantee compliance of, material so labeled by manufacturers, but will, in event of a dispute between a member of the Association and a manufacturer, act in an advisory capacity and will designate testing laboratories having equipment for testing dental amalgam alloys where necessary tests may be made.

A comparison with the former specification[1] will show the following changes: (1) inclusion of a protective against blackening; (2) broadening of the chemical composition limits; (3) deletion of the ultimate compressive strength requirement; (4) reduction of the maximum flow value from 5 to 4 per cent; (5) change in the dimensional change on setting values from 1 to 10 microns per centimeter to 3 to 13 microns per centimeter; (6) deletion of the allowed 4 micron maximum contraction to the first minimum.

TABLE 6.—A.D.A. SPECIFICATION NO. 6 FOR DENTAL MERCURY*

Mercury	Manufacturer
Argentum	Hammond Dental Mfg. Co.
Chemically Pure	S. S. White Dental Mfg. Co.
Dee	Thomas J. Dee & Co.
Dental	Goldsmith Bros. S. & R. Co.
Mercury Laboratories	Mercury Laboratories, Inc.
Minimax	The Minimax Co.
Mission	San Diego Smelting and Refining Co.
Odontographic	Odontographic Mfg. Co.
Positively Pure	Garhart Dental Specialty Co.
R. P. C.	Research Products Corporation

*J.A.D.A., January, 1932.

TABLE 7.—A.D.A. SPECIFICATION NO. 7 FOR WROUGHT GOLD WIRE ALLOYS*

Alloy	Manufacturer
Hylastic	Patterson-Hettinger Co.
Deepep-Hard	Thomas J. Dee & Co.
High Fusing Clasp	Goldsmith Bros. S. & R. Co.
Medium Clasp	Goldsmith Bros. S. & R. Co.
Regular Clasp	Goldsmith Bros. S. & R. Co.
Research No. 22	Precious Metals Research Works
Spyco No. 3	Spyco Smelting and Refining Co.
Spyco No. 4	Spyco Smelting and Refining Co.
Stern No. 2657	I. Stern and Co., Inc.

*J.A.D.A., December, 1932.

1. Taylor, N. O.: Specification for Dental Amalgam Alloys, J.A.D.A., 17:112 (Jan.) 1930.

REVISED ITEMS

General.—All of the changes were very minor ones. No suggestions involving drastic changes were received. The Association's amalgam specification has been in use since 1929. It is identical (as far as physical properties are concerned) with the Federal Specification No. UA-451 (formerly No. 356) which has been in use since 1926. The testing of amalgam alloys over this period of years by both the Government and the Association has shown that the manufacture of these alloys has progressed sufficiently to permit making some of the requirements of the specification more stringent.

Chemical.—It might be preferable not to have requirements for both chemical composition and physical properties in the specification. No tarnish or solubility tests which will simulate mouth conditions are available. It was therefore necessary to retain certain requirements as to composition. The changes made in these requirements permit greater variation in composition. Practically all of the satisfactory alloys which have been made during the last fifteen years come within the specified limits of chemical composition.

Ultimate Compressive Strength.—This requirement is unnecessary as experience shows that alloys which pass the flow and setting change requirements will invariably meet the crushing strength requirement. No alloys have been rejected on failure to pass the crushing strength value alone; i.e., the sample's flow would be too high or the shrinkage would be excessive, or both, for all alloys the crushing strength of which was too low.

Flow.—The reduction of the maximum allowable flow from 5 to 4 per cent also increases the early compressive strength and automatically eliminates the slow setting alloys, many of which have been found to shrink on setting.

Setting Change.—Certain alloys which are now on the lower border line in setting changes would be rejected as a result of harsh treatment in mixing and packing. The revision of this requirement will make it difficult for alloys of this type to comply with the specification and will tend to protect the dentist who insists on using a very heavy trituration pressure.

Since amalgams which initially contract more than 4 microns per centimeter will seldom recover sufficiently on the expansion phase to comply with the new specification, the requirement relating to the initial contraction has been deleted. These changes should ensure the user against a shrinking amalgam under any reasonable variation of technic.

Mixing and Packing Technics.—Directions for mixing and packing should be supplied by the manufacturer in accurate and adequate detail. If he wishes his alloy to be ground in the mortar with heavy hand pressure for three minutes, or, for instance, triturated lightly with the least pressure with which the mercury and alloy can be united, it should be stated in such a manner that the directions are clear. When alloys are tested for conformity to the specification, they should be mixed and packed according to the directions of the manufacturer who produced them.

The instructions which accompany the package can be made specific enough for the preparation of the test specimens. This, too, has the added advantage of making the test specimens as nearly as possible like the material which will be used in practice.

The printed directions which shall accompany the package should contain all of the details mentioned in Section V of the specification. Such directions are not impractical and should improve the quality of amalgam restorations.

The cooperation and interest of the dental schools and the manufacturers who assisted in this revision is appreciated. It is the policy of both the Bureau of Standards and the American Dental Association to welcome any suggestions relative to the improvement and strengthening of these specifications. Such comment is extremely valuable if the suggestions are accompanied by definite numerical values and confirmatory data.

CERTIFICATION

Pursuant to the policy of the Research Commission,[2] various manufacturers were asked to certify that their products would meet the specifications of the Association. These certifications are solely the responsibility of the makers. Neither the Bureau of Standards nor the Research Commission approves, certifies or guarantees any dental materials.

Two previous lists of certified materials have been published.[3] The present list has only those certifications which were accompanied by representative test data and executed as outlined in the statement of the Research Commission.[2]

Lists of dental materials which are certified to the Research Commission by the manufacturers as complying with the American Dental Association's Specifications are given in the accompanying tables.

2. Dental Research Fellowship at National Bureau of Standards, J.A.D.A., 20:1040 (June) 1933.

3. Footnote 1. Taylor, N. O., and Paffenbarger, G. C.: Progress Report on Research on Dental Materials (1931), J.A.D.A., 19:404 (March) 1932.

RESTORATION OF LOST FACIAL DIMENSIONS AND FACIAL HARMONY*

By J. W. CRAWFORD, D.D.S., F.A.C.D., Milwaukee, Wis.

WILLY POGANY, artist, is credited with saying: "No perfectly beautiful woman is interesting. Freckles make her countenance more attractive. Eyes and a mouth that do not match have charm. Contradictions make the feminine face appealing and intriguing."

Denture specialists have long recognized the fact that harmonious blending of facial contradictions is the basis of their services. The key to this blending is a building up of the structures around the mouth, and tooth and arch arrangement.

Years ago, George S. Monson, of St. Paul, taught the importance of facial dimensions and facial harmony in denture construction, as well as the building up of natural occlusion to attain that end. A demonstration in the extremes in contrasts was evident in the characterization of Lon Chaney, who, with the aid of Dr. Howard, of Hollywood, designed and constructed exaggerations in tooth form and position and mouth form that were largely the basis of those characterizations.

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 9, 1933.

Personality is dependent on facial charm, not beauty, for its appeal. The mouth makes for or mars that charm.

Dentures are more efficient when anatomic restorations are established. The patient cooperates more readily when the facial appearance is pleasing. Much of the dread of wearing dentures is eliminated when a knowledge of improving the facial appearance is made the basis of our work.

The eyes, the voice or the smile may be the particular source of charm, but any or all of these are dependent on the mouth and surrounding structures for the accentuation of that charm. An unattractive mouth often makes its possessor self-conscious to the point that ability and effort are stifled.

Fig. 1.—Facial charm accentuated by harmonious mouth and teeth.

Correcting these defects becomes a simple matter in the hands of those that understand facial harmony and proportion. "Those who undertake to make another normal must know what normal is."

HOW AND WHY PROPER FACIAL DIMENSIONS ARE LOST

More than 75 per cent of children from 5 to 15 years of age are in need of some degree of orthodontia. Here we see the beginning of lost facial harmony and dimension. Early extraction of teeth hastens the process. Failure to restore tooth structure and contour in placing fillings, crowns, etc., brings about a further shortening and change in the occlusion. While the latter process may be slow, the result is inevitable. Facial aging, much swifter than the passing of the years, is brought about by a shortening or mushing of the structures around the mouth.

As an aid to incorporating individuality in denture work, preextraction records should be made. These consist of: (1) two profile and two front view photographs, one each, smiling and in repose; (1) upper and lower impressions taken in wax or denticoll, and facial measurements taken from a fixed point.

The Sorenson dentofacial scale has the nasion or bridge of the nose as a fixed starting point and is graduated from a horizontal line drawn through the pupils of the eyes. This is the most accurate instrument for this purpose that I have seen.

Measurements recorded are: (1) from nasion to gnathion (bridge of nose to tip of chin); (2) nasion to nasospinale (bridge of nose to nasal spine); (3) nasion to lip line; (4) nasion to incisal edge of upper central incisors; (5) nasion to incisal edge of lower central incisors; (6) the anterior posterior position of the upper central incisors.

Fig. 2.—Toning down facial and physical contradictions in portraiture.

Fig. 3.—Abnormal facial conditions that could be improved by dentures.

The last measurement will vary somewhat if the bite is opened or closed and must be computed.

AVERAGE SYMMETRICAL FACIAL DIMENSIONS

The face may be divided into four sections, A, B, C, D. The position of the incisal edge of the upper central in relation to A and D and C, the lip line, may be indicated by E; the relative position of the lower incisal edge in relation to A and D, by F.

In the few hundred cases with all teeth intact, and of a high type of development, so far measured, A and C equals B and D. Also, the distance in millimeters from A to D should be ten times the length of the crown of the upper central incisor measured from the gingival to the incisal margin on the labial surface. These proportions vary only slightly as asymmetry develops.

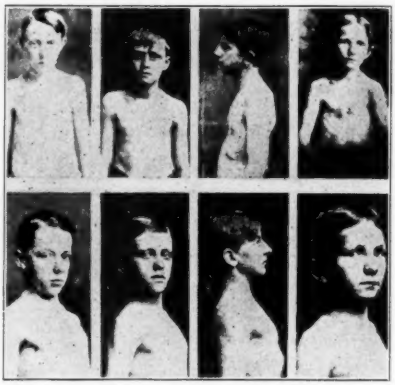

Fig. 4.—Improvement of physical condition as well as dental through diet and establishment of proper function.

Excessive overbite indicates excessive development of the maxilla or loss of the posterior teeth. The end to end bite indicates excessive mandibular development. The protruded mandible also indicates mandibular development or retarded development of the maxilla. In full denture cases, these abnormal conditions can all be improved by establishing as nearly as possible the harmonious facial proportions found in the highly developed cases.

When preextraction measurements are made and recorded, any corrections desired should be calculated at that time and recorded. If no preextraction records are available, occlusal rims should be made to establish the distance B to D as equal to A to C. Taking this as a starting point, the eye quickly notes either the strain of the lips, indicating need for a shorter dimension or a pouching of the lips indicating that a greater length is necessary for the occlusal rims.

The posterior portion of the occlusal rims is trimmed to the width of bicuspids and molars, not over a quarter inch, and set directly over the ridge to permit freedom of tongue movement. The slightest discomfort to the patient, occasioned by too great or too short a vertical dimension, is indicated on the lips and face, and when the proper opening is made, the harmonious facial expression will be very evident.

The median line is now marked, as well as the horizontal lip line. The cuspid position and the high lip line on the upper denture are then marked, and the low lip line on the lower is marked on the occlusal rims. Labial and buccal contour is restored, if necessary.

With the correct vertical relation established, the patient relaxes and is comfortable, and all strain and effort disappear. The centric relation is easily established now, and gothic tracings are more easily made and show less variation.

The vertical relation is now established on the articulator. Any changes in the vertical or centric relationship as now established on the articulator means a change in facial harmony and will require correction in the mouth and another mounting on the articulator.

Up to this point, establishing facial proportion or dimension has been a simple matter of opening or closing the bite. At this point, facial harmony enters, having to do with muscular action as

Fig. 5.—Improvement through shortening facial dimension.

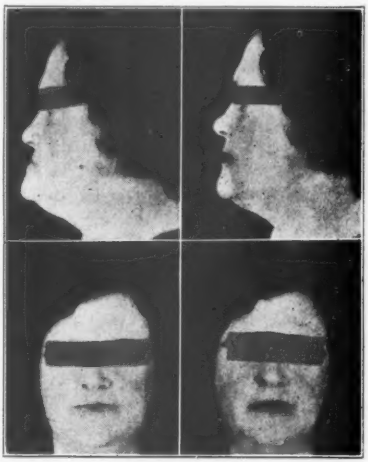

Fig. 6.—Lengthening facial dimension. The degree of lengthening should be calculated with wax rims.

well as tooth position, size, shape and color.

The artificial tooth should match the natural tooth as nearly as possible in size and shape. Where the natural teeth are not available, a photograph can be used to advantage. This picture should show the patient smiling, if possible. A kodak picture is often a great help.

Any picture to be of value must be taken before the natural teeth have been removed and before too much change has taken place.

PONTS' TABLE OF ARCH MEASUREMENTS

Combined Width of Central and Lateral Incisors	Width Between Occlusal Fossa and First Upper Bicuspid	Width Between Occlusal Fossa and First Upper Molar, Central Fossa
Mm.	Mm.	Mm.
25.0	31.0	39.00
25.5	32.0	39.80
26.0	32.5	40.90
26.5	33.0	41.50
27.0	33.5	42.50
27.5	34.0	42.96
28.0	35.0	44.00
28.5	35.5	44.50
29.0	36.0	45.30
29.5	37.0	46.00
30.0	37.5	46.87
30.5	38.0	47.60
31.0	39.0	48.40
31.5	39.5	49.20
32.0	40.0	50.00
32.5	40.5	50.80
33.0	41.0	51.50
33.5	42.0	52.30
34.0	43.0	53.00
34.5	43.5	53.90
35.0	44.0	54.50

This will then often show the shape, size and position of the natural teeth. The length of the artificial central incisors should be one-tenth the length from A to D. The width should be proportionate for square, ovoid or tapering types.

When the proper vertical or opening dimension is established, the lip drapes over the occlusal rims, and setting the teeth in the proper position is less difficult.

The occlusal rims are kept intact except the space for the six upper anterior teeth.

If we have been careful to get proper facial contour through proper fullness of the rims, we set the six anterior teeth on the line established by the wax rims in the median line and to the length marked for the horizontal lip line. The four incisors are set out to support the lip. The incisal edge is brought out and the gingival in. Too great fullness of the lip is more easily detected and corrected. The cuspids are set out to support the corners of the mouth.

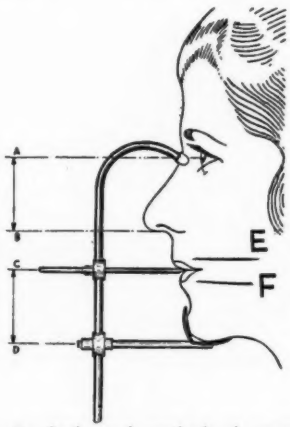

Fig. 7.—Scale and method of measuring facial dimensions.

A slow strained tense movement of the lips in smiling and talking indicates too much fullness or too much length. If care is taken to get free lip movement over the six upper anterior teeth, the position of the other teeth is more easily determined.

More mistakes are made by not hav-

ing the six upper anterior teeth the right size and in the right position to allow a free, unhampered movement of the lip. The six anterior lower teeth are now placed over the lower ridge, the posterior wax rims are still in place to maintain the vertical opening. The free upper lip movement established, the lower anterior teeth should set in a line from the lower ridge to the lingual flange of the upper teeth with a slight overbite permitting the lower lip to rest below and back of the upper lip without strain.

Further individual tooth arrangement is left until all the posterior teeth are in place.

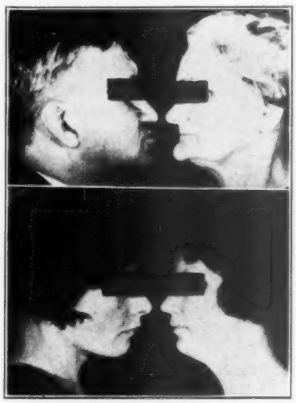

Fig. 9.—Above: Shortened dimension. Below: Lack of mandibular development.

To obtain proper arch width, the accompanying table (Ponts') of arch measurements based on measurements of natural teeth and corresponding arch widths is used.

Proper arch width cannot be established unless the anterior teeth are of a corresponding width. The proper vertical opening with Ponts' arch width produces the right vertical and horizontal tongue space. If the occlusal line is properly established, the upper half of the tongue will rest above the incisal and occlusal line of the lower teeth, and in contact with each tooth when the mouth is partly open and the patient relaxed.

When there is space between the tongue and the lingual edge of the teeth or the tongue is crowded, there is an error in tooth position.

STEPS NECESSARY FOR PHONETICS IN FULL DENTURE CONSTRUCTION

To assure proper phonation in full denture construction, the following demand attention:

(1) the proper opening or vertical dimension; (2) the anteroposterior position and arch of the six anterior upper and lower teeth; (3) the width in bicuspid and molar region, and arch form; (4) the occlusal line, which must permit the upper half of the tongue to rest above but in contact, not crowded, with the linguoclusal edge of the lower teeth.

If the preceding steps have been followed accurately, the following suggestions to establish individual facial harmony will be of great benefit.

1. Do not crowd the anterior teeth.
2. Twist the anterior teeth to give the appearance of crowding, but leave space enough to draw a paper between the teeth.
3. Leave a space between the central incisors, or lap them.
4. Lap the mesio-incisal corner of the lateral incisors over the central, or set the lateral slightly linguad from the central and the cuspids.
5. Tip the gingival edge of the lateral incisors in more than that of the central.
6. Flare the distal edge of the lateral incisors labially.
7. Flare the distal edge of the central incisors labially.

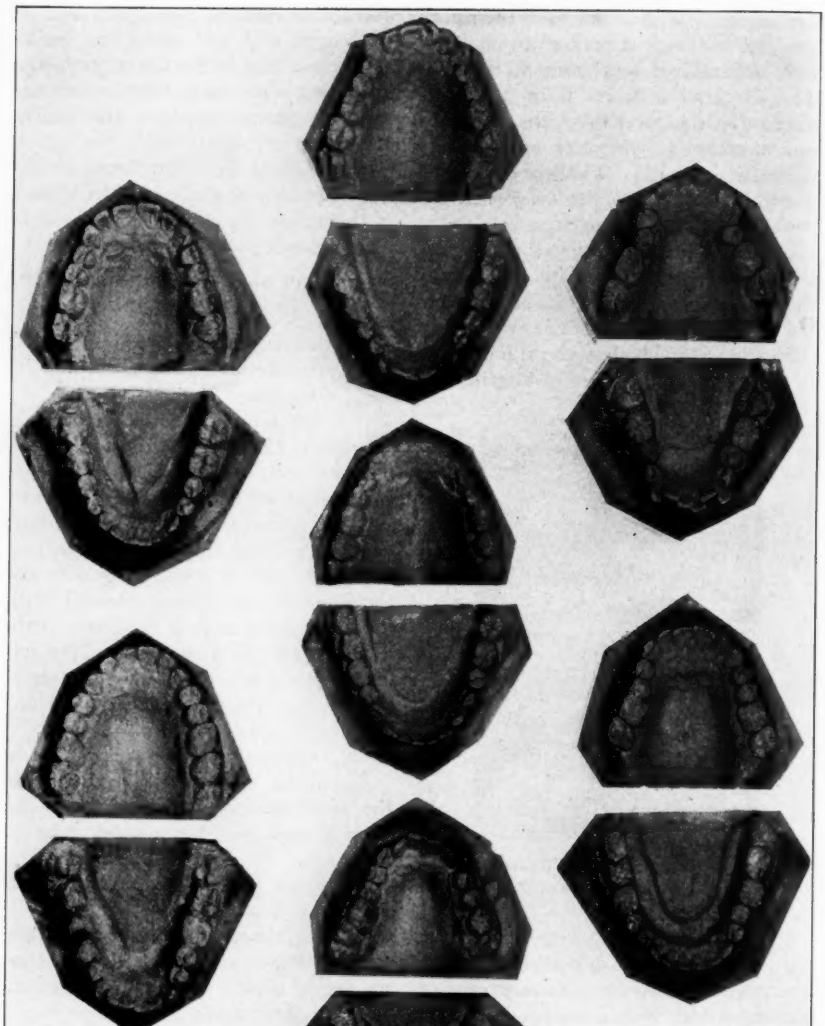

Fig. 8.—Tooth arrangement.

8. Set the lateral incisors linguad from the central.

9. Twist the cuspids, mesial in and distal out.

10. Twist the cuspids, distal in and mesial out.

The same can be done with the lower anterior teeth, only more pronouncedly than with the upper.

An apparently careless arrangement of the individual tooth is more effective than a symmetrical stiff arrangement. Avoid extremes, taking impressions of natural teeth of a high type of development, in patients of about 18 to 20 years of age. Tooth arrangement should be regular and irregular. Casts should be used as study models for tooth arrangement, angle and tooth position.

Staggering of colors is very necessary. Lateral incisors and cuspids should be slightly darker than the central incisors. A slight variation or difference of color blending is very effective, if not too pronounced.

Anesthetics have eliminated the dread of dental operations. The "injection" of facial harmony and correct facial proportions and the blending of tooth color, shape, size and arrangement in dentures will put charm and appeal into an otherwise unattractive face and bring appreciation on the part of the edentulous patients to what sometimes seems a discouraging and wasted effort.

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ROENTGENOGRAPHIC STUDIES DURING CHILDHOOD*

By GEORGE E. MORGAN, D.D.S., F.A.C.D., Milwaukee, Wis.

A VAST amount of knowledge of the teeth and jaws of a child can be gathered from roentgenographic studies made during the growth and developmental periods. The importance of roentgenograms in the examination and diagnosis cannot be too greatly stressed. Many truths are revealed and mutilation of many mouths can be prevented by a knowledge of the changes which normally take place in the jaws during childhood. Prevention to be most effective must begin with the child. It is during these developmental periods of the teeth and jaws that a better understanding of what is taking place in the jaws of a child is necessary. Schoeny[1] says, "Our roentgenography in the case of small children has in the past been far from what could be desired, and consequently many little patients have suffered for want of a thorough and complete roentgen ray examination and diagnosis."

If a roentgenogram were taken of an infant at birth, you would find that the calcified areas of the teeth are in a very crowded condition within the jaws. Every tooth germ is overlapping its neighbor. Many are impressed with the amount of calcification which has taken place in the jaws even before birth. It is in early infancy that much can be done to promote or interfere with the development of the

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 10, 1933.

1. Schoeny, L. J.: Early Roentgen Ray Diagnosis of Dental Conditions in Young Children, J.A.D.A., 19:2043 (March) 1932.

teeth. Preventive dentistry has failed to stress the importance of prenatal development of the teeth not only to our profession but also to the medical profession. During this early developmental period, we may take the liberty of calling attention to a diet for better tooth development.

By the constant study of periodic full-mouth roentgenograms (Fig. 1), the time of calcification of each permanent tooth can be more definitely determined. There seems to be no uniform relationship between beginning and complete calcification, and the eruption of the permanent teeth.

The bite-wing examination as advocated by Raper[2] is not practical for children because we are interested in more than just the proximal surfaces. A knowledge of the comparative growth and development of the jaws at various ages of childhood is important. Roentgenographic examination of the jaws of a child at regular intervals and a comparative study of the roentgenograms at different ages enable us to visualize the changes occurring in the jaws of the same child. In the early years, it is difficult to obtain roentgenograms, and if there is still an overlapping of the teeth, little can be determined from an extra-oral roentgenogram.

In children's dentistry, by continually studying roentgenograms, we can visualize what is occurring in the jaws of a child of $3\frac{1}{2}$ years. (Fig. 2.) The crown of the first permanent molar is fully calcified, and a great part of the enamel of the first bicuspid is formed, while the second bicuspid has just begun to calcify. You will also observe that the second permanent molar cusps are just beginning to form. The roots of the deciduous molars in a child's jaw are considerably more divergent than the roots of the permanent molars of an adult at the same height of development. These diverging roots provide ample space for the follicle of the succeeding permanent tooth and must be kept in mind in the extraction of diseased deciduous teeth.

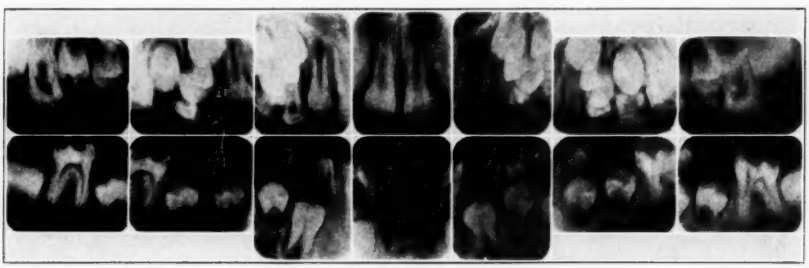

Fig. 1.—Full mouth roentgenogram.

Many times, by roentgenographic study of children, hypoplasia[3] of the teeth is revealed prior to eruption. (Fig. 3.) It is by knowing these truths at an early age that causative conditions can be determined. The condition resulting in hypoplasia affects only the teeth at a certain stage of development. Owing to the

2. Raper, H. R.: Practical Clinical Preventive Dentistry Based upon Periodic Roentgen Ray Examination, J.A.D.A., 12:1084 (Sept.) 1925.

3. Molt, F. E.: Dental Roentgenography, J.A.D.A., 12:432 (April) 1925.

fact that the permanent teeth do not develop simultaneously, the hypoplastic defects are not distributed uniformly.

A study of the anatomic characteristics of deciduous and permanent molars is necessary for proper cavity preparation. Simpson[4] says, "Radiographic examination preliminary to cavity preparation is advantageous in outlining and locating the pulp chamber and the recessional pulpal horns, to avoid accidental exposure or dangerous approach." The deciduous molars have larger pulp chambers, the enamel is thinner and the crowns are more nearly bell-shaped than in the permanent molars. Not only will roentgenograms reveal these anatomic differences, but they will many times also reveal caries in the proximating surfaces of the deciduous molars which it is difficult to detect with an explorer. (Fig. 4.)

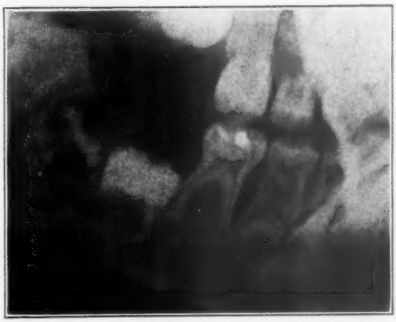

Fig. 2.—Development of dentition in child, aged 3¼ years.

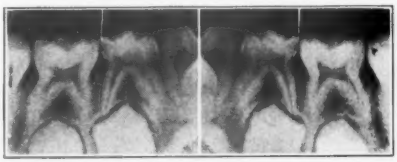

Fig. 4.—Caries in proximal surfaces of deciduous molars.

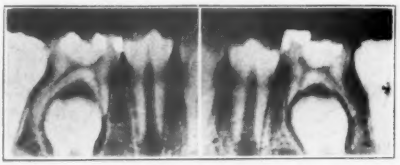

Fig. 5.—Case in which first bicuspid was in contact with filling in second deciduous molar for year or longer.

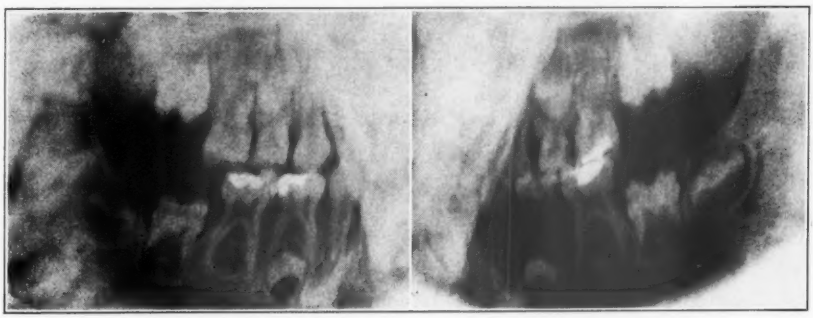

Fig. 3.—Hypoplasia of first permanent molars in child, aged 5 years.

In the placing of fillings in the proximal surfaces of the deciduous molars, roentgenograms will show that the first bicuspid is developing in advance of the second bicuspid, and will, if eruption is

4. Simpson, C. O.: Radiography in Operative Dentistry, J.A.D.A., 11:12 (Jan.) 1924.

normal, be in contact with the second deciduous molar for a year or more. (Fig. 5.) Therefore, it is important that the filling be placed in the second deciduous molar first. A smooth and well-polished mesial surface of the second deciduous molar makes the distal surface of the first bicuspid less susceptible to decay. Overhanging and unpolished fillings are a source of infection and provide a harbor for food. Many of us fail to realize that the exfoliation of the deciduous teeth and the eruption of the permanent teeth have a direct bearing on which tooth should be filled first. Only by the persistent use and study of the roentgen rays can dentistry for children continue to be evaluated.

The exfoliation of the deciduous teeth and the eruption of the permanent teeth present a study that is aided considerably by the use of the roentgen rays, and that should be of great interest to those of us who do dental work for children, that we may help the jaws develop normally by removing the deciduous teeth from the arches at the proper time. The deciduous teeth have not received the consideration due them; and, in some cases, their importance has been overlooked and they have been neglected. The exchange of the deciduous teeth for their permanent successors and the further development of the jaws constitute quite a complicated and interesting process. Unless these changes occur normally, the permanent teeth will not be in normal occlusion.

Fig. 6.—Dentition showing lack of uniformity of exfoliation of deciduous teeth.

Fig. 7.—Fillings in child, aged 3 years. Cavities in deciduous incisors should be filled, not ground wedge shape.

Fig 8.—Submerged deciduous molar. (Abbott.)

The exchange of the deciduous molars for the bicuspids is extremely important; for unless the arches develop uniformly and harmoniously in the deciduous molar region, malocclusion is almost certain to result. In the eruption of the bicuspids, the first bicuspid erupts in advance to the second. There is a definite time when each deciduous molar should be lost, and this time can be determined only by roentgenographic study, as it varies in all children. (Fig. 6.) In our work for children, we must never lose sight of the relationship of the individual tooth to the development of the teeth and jaws. The deciduous molars are the most important of the deciduous teeth as they have a greater influence on normal development.

Fig. 9.—Submerged deciduous molar causing impaction of bicuspid.

Fig. 10.—Supernumerary tooth causing diastema of upper central incisors.

The deciduous incisors are smaller than their permanent successors, and as the jaws develop, spaces form between the teeth. Many children, before this space formation in the incisal region of the jaw and usually around 3 years of age, develop caries in the proximal surface of the upper central and lateral incisors. The roots at that age show little resorption and are usually at the height of their development. If these teeth are not restored to their natural shape and function, space development will not be normal. These teeth should be filled instead of being ground wedge-shaped, as has been advocated. (Fig. 7.) The lack of sufficient space for the permanent upper incisors may be due to premature loss of the deciduous incisors or the failure to restore these teeth properly. By roentgenograms, one can determine the development necessary for the permanent successors of the deciduous incisors. If the lower deciduous incisors are lost prematurely, the result may be the narrowing of both the upper and the lower incisal regions of the arches and the crowding of the permanent successors.

Fig. 11.—Supernumerary tooth at apex of central incisor.

Fig. 12.—Congenital absence of second bicuspid with partial resorption of deciduous tooth.

Sometimes, we may encounter submerged deciduous molars. (Fig. 8.) These teeth cease to move occlusally and become impacted. A deciduous tooth out of function may hinder the eruption of the permanent successors. If the submerged tooth is left in the mouth indefinitely, it may fail to resorb and cause the impaction of its permanent successor. (Fig. 9.) Only by a thorough knowledge of what takes place during the growth and developmental periods of the jaws of a child can we guide the teeth into their normal positions. The state

Fig. 13.—Congenital absence of second bicuspid with almost complete resorption of deciduous roots.

Fig. 14.—Congenital absence of second bicuspid with partial resorption of deciduous roots.

of the permanent teeth is greatly influenced by that of the deciduous teeth during childhood. Any tooth which is out of function in the mouth may also be a source of disease. As the body needs exercise, so do the teeth, in order to remain healthy and strong.

Dental anomalies are frequently found in the mouths of children and may be recognized with the process of development prior to eruption. In the region of the upper central incisors, the roentgenographic examination sometimes reveals a small peg-shaped impacted supernumerary tooth. This tooth usually causes a diastema between the upper central incisors. (Fig. 10.) If it erupts, it may come into the palatal region between the upper central incisors. Most frequently, it remains impacted and hinders the normal alinement of the central incisors. The abnormal relationship between the arch and the central incisors cannot be

Fig. 15.—Congenital absence of permanent lateral incisor.

Fig. 16.—Congenital absence of permanent central incisors with no resorption of deciduous teeth.

corrected until the supernumerary tooth is removed. The cause of the diastema would not have been discovered without the roentgen rays. Sometimes, we find a supernumerary tooth developing at the apex of the permanent central incisors (Fig. 11) in the mouths of children. Usually, these teeth never erupt, and if they are not discovered in our roentgenographic studies of the child, they may never be removed. Development of the

tooth in the apical region of the central incisors may cause resorption of the root of the permanent tooth by pressure. Consequently, if it is not discovered early and removed, loss of the permanent tooth may result.

Frequently, it is found that children in whom one would least expect to find such a condition, the successors to many of the deciduous teeth are missing. In our work for children, we must constantly be guided by the condition present in the jaws. May I again stress that periodic roentgenographic studies play an important part in the proper care of children's teeth. The safest procedure is to make complete roentgenograms of all the teeth; for we are often surprised to find abnormal conditions in mouths which give no other evidence of abnormality. Each year, the jaws change, and a satisfactory arrangement of the teeth is essential for the normal function of all organs, in a child as well as in an adult.

The roentgenographic studies of the deciduous teeth during childhood often reveal the fact that many children have missing bicuspids. I believe that the lower second bicuspids are more frequently absent than are the upper second bicuspids. In many mouths, these deciduous teeth with no permanent successors show little or no resorption of the roots. (Fig. 12.)

Kronfeld[5] states that "the roots of the deciduous teeth are resorbed by the connective tissue between the permanent and deciduous teeth; the stimulus for the resorptive process comes from the erupting tooth." Then, too, roentgenograms will sometimes disclose deciduous molars undergoing resorption, even though no permanent successors are present. (Figs. 13-14.) In these cases, Kronfeld[5] says that "a kind of senescence can be observed . . . and as a result even those without permanent successors are resorbed and finally eliminated."

Only slight resorption of one root with almost complete resorption of the other root when no permanent successors are present may also be found in the mouths of children. We also find cases in which there are no upper permanent lateral incisors. The cuspid usually causes resorption of the roots of the deciduous lateral incisor as well as of the cuspid. (Fig. 15.) The lower permanent central incisors are not often absent, although they are missing in some cases. (Fig. 16.) In some persons, the deciduous teeth without permanent successors are retained for a number of years; while, in other cases, they are lost early in life. Knowing that it is possible for these con-

Fig. 17.—Congenital absence of lower left second bicuspid in child, aged 10 years. The deciduous roots have not resorbed.

5. Kronfeld, Rudolf: Resorption of Roots of Deciduous Teeth, D. Cosmos, 74:103 (Feb.) 1932.

ditions to be present in many children, we must have a thorough mental picture of the changes taking place in the jaws in order to render the best possible health service to the child. It has been found, through roentgenographic studies, that the congenital absence of the teeth may be bilateral or unilateral. (Fig. 17.) We must be sure that every deciduous tooth has a permanent successor, as this fact has a direct bearing on our operative procedures and also on the normal alinement of the teeth.

Roentgenographic examinations are an aid in discovering involvement of the pulp and disclose chronic abscesses of the teeth of children as well as of those of adults.

Fig. 18.—Premature eruption of teeth.

When deciduous teeth are badly abscessed and a great amount of the alveolar process has been lost beneath the deciduous tooth and over the crown of the permanent tooth, we have premature eruption. (Fig. 18.) The prematurely erupted tooth may be exfoliated owing to the lack of sufficient root formation to retain it in the jaw.

In a study of focal infection during childhood, it seems that the seat of the primary lesion may be the teeth. (Fig. 19.) The fact that premature loss of the deciduous teeth has been so strongly opposed and that it is one of the main causes of malocclusion leads one to believe that many of us lose sight of the possible pathologic condition of these teeth. Drain[6] mentions that "detection of incipient caries should be the paramount consideration in patients of all ages, and especially during the childhood period, since the early effects of extensive dental destruction are not easily erased." If infection is present in the mouths of young children, the pain and discomfort in mastication alone leads to a malnourished condition as well as to gradual lowering of the resistance. It is during the early years in life that every child builds a strong body, and unless the mouth is kept in a healthy condition, we fail to do our part in maintaining a healthy body for our child patient.

When resorption of the roots of the deciduous teeth is abnormal, we find that the crowns of the deciduous molars are exfoliated while the roots remain intact in the jaw. (Fig. 20.) These roots should be removed as they tend to throw the succeeding tooth out of alinement and are also a source of pathologic processes. A large percentage of cases of malocclusion are caused by a prolonged retention of the deciduous teeth due to abnormal resorption of their roots. This is particularly true of the deciduous molars. (Fig. 21.) The impaction of permanent cuspids is frequently caused by the prolonged retention of the deciduous cuspid. (Fig. 22.) When the deciduous cuspid is removed, the permanent tooth will usually erupt to its normal position. Without the use of the roentgen rays, proper procedure in these cases would be hard to determine.

Before and during orthodontic treatment, roentgenographic studies of the individual child are essential. It is possible to predetermine the presence and the position of the unerupted teeth as well as the anatomic relationship of the deciduous and permanent teeth. Roentgeno-

6. Drain, C. L.: Roentgen Rays in Children's Dentistry, J.A.D.A., 18:1154 (June) 1931.

graphic studies of facial deformity are used to advantage in orthodontic treatment. The roentgenographic profile[7] shows the relationship of the teeth to the contour of the face. It also enables one to know the position of the mandible when treatment was begun and after malocclusion has been corrected. (Fig. 23.)

If the deciduous molars are lost prematurely, there is a shifting of the

Fig. 19.—Abscessed deciduous teeth, which should be removed.

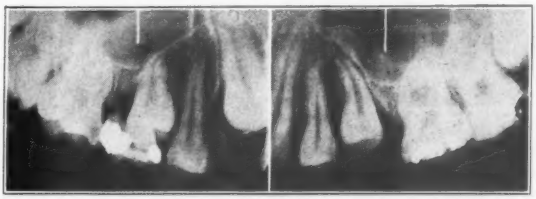

Fig. 20.—Deciduous roots that have not resorbed and so must be removed. (Bell.)

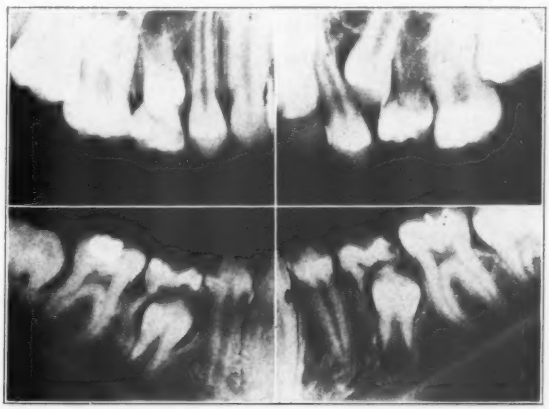

Fig. 21.—Prolonged retention of deciduous teeth causing malposition of permanent successors.

erupted teeth causing an impaction of the unerupted permanent successors. (Fig. 24.) If normal occlusion is to be obtained in these cases, orthodontic treatment will be necessary to move these

7. Dewey, Martin, and Riesner: Radiographic Study of Facial Deformities, Internat. J. Orthodontia, 14:261 (March) 1928.

teeth into their proper positions in the arch. If the erupting teeth are impacted owing to the lack of space retainers, orthodontic treatment must be undertaken early, that Nature may assist in the normal alinement of these teeth.

Preventive dentistry for children cannot be practiced without roentgenographic knowledge of the teeth and jaws of every child. The deciduous dentition is different from the permanent, and roentgenograms are indispensable for the study of the normal and abnormal conditions that are found in the mouths of children. It is only by the consistent use of the roentgen rays that we can fully evaluate dentistry for children. It is only by knowing the conditions present in the jaws of our child patients that it is possible for us to give them the professional service to which they are entitled. It is only by our unselfish endeavor that dentistry for children can continue to progress for the betterment of mankind.

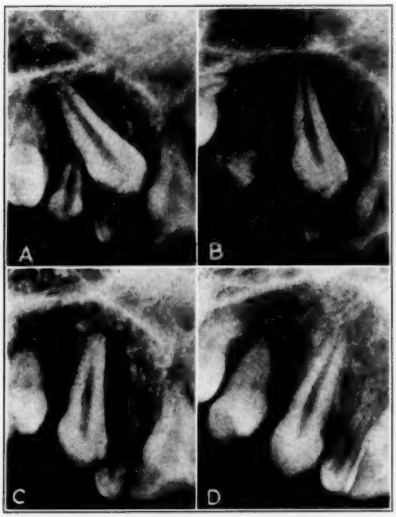

Fig. 22.—*A*, prolonged retention of deciduous cuspid. *B*, appearance after removal of deciduous cuspid. *C* and *D*, permanent cuspid erupting to normal position.

Fig. 23.—Roentgenographic profile.

Fig. 24.—Left: Premature loss of deciduous molars causing malocclusion of permanent teeth. Center and right: Malposition corrected by orthodontic treatment.

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A METHOD OF CASTING ORTHODONTIC ATTACHMENTS

By OSCAR JACOBSON, D.D.S., New York City

THE advance of the mechanical aspect of orthodontic technic has concerned itself with improving force control by gaining better means of attaching appliances to the teeth. The history of this evolution interests us, as it may shed light on the "newness" of some of our methods.

Over fifty years ago (1882), John J. R. Patrick described a method of treatment involving the use of a half-round bar or alinement arch, used vertically with the flat side toward the teeth. By the use of carefully fitted slides or "brackets," he obtained more accurate force control than had hitherto been described.[1]

The development of this principle began then, and, under the hand of Edward H. Angle, was brought to completion in 1928, with his publication of the edgewise arch mechanism. The various intermediate advances made by this genius are known to every student of orthodontics.

In 1915, R. D. Robinson also made a careful study of the bracket principle,[2] in which he utilized flat blocks and seats or slots. Robinson attempted the use of square wire, but found it unsuited to his method, which involved loops. He also experimented with triangular wire and with flat wire with a groove milled to fit a lug on the band. Robinson's work terminated in the use of a round wire with flat blocks and seats, locked by a pin. This same technic has been perfected and refined by Edward M. Griffin.

Up to the present, most orthodontic attachments have been manufactured, and while the efforts of the men who have made them deserve the fullest praise, some disadvantages have accrued, chief among these the fact that, in order to manufacture small parts quickly, it is desirable that they be made of a soft metal; which leads to a lack of durability. Then, too, it is not always possible for the orthodontist to procure parts of variable size to meet special conditions. The factor of expense is also one that merits consideration. It is with the hope of helping to overcome these disadvantages that the following technic is described.

The innovation offered consists of casting bracket attachments. These are cut from a bar or ribbon of cast gold, of the proper cross-sectional form. (Fig. 1.) The method of producing this cast ribbon is simple in principle, and its execution should occasion no exceptional difficulties. Furthermore, in order to make his own bracket attachments, the

1. Weinberger, B. W.: Orthodontics, Historical Review of Origin and Evolution, St. Louis: C. V. Mosby Co., 1926, vol. 2, pp. 602-604.

2. Robinson, R. D.: Internat. J. Orthodontia, 1:397 (Oct.) 1915.

orthodontist need not invest in expensive machinery. The articles needed are: (1) a metal hypodermic syringe or wax gun, (2) casting wax and (3) a jeweler's saw. The castings can be made by a laboratory after the wax ribbon has been formed.

This wax ribbon can be made in two ways: (1) by forcing warmed wax under pressure through a nozzle the opening of which is of the required form, or (2) by placing the wax in a separable mold and pressing it into the proper shape. Both methods will be described. Possibly some manufacturer will further simplify the technic by making these parts.

Fig. 1.—Ribbon of cast gold, front and side views.

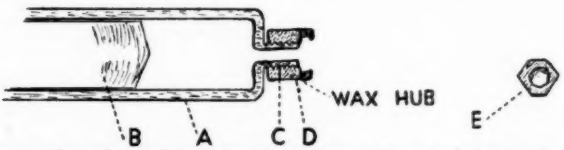

Fig. 2.—Cross-section of metal hypodermic syringe with wax hub attached. *A*, syringe barrel; *B*, plunger; *C*, threaded end; *D*, wax hub; *E*, end view of wax hub.

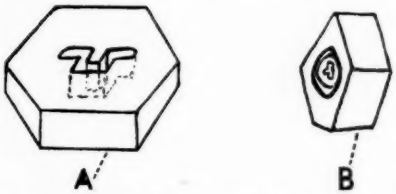

Fig. 3.—Method of waxing nozzle. *A*, attachment with wax disk; *B*, side view showing recessed portion.

WAX GUN TECHNIC

For the wax gun technic, we can use either a wax gun, also known as a sprue former, or an old metal hypodermic syringe. The first step is to cast a hub to fit the threaded end of the barrel. Oil this portion, carefully melt hard inlay wax over it and allow to cool. Carve the wax into the form of a nut, recess the exit (Fig. 2) and remove by unscrewing. Two sprues should be attached to this wax hub, and the piece carefully invested and cast. The recess is filled with investment material, which is gently vibrated through. If the casting does not go to

Fig. 4.—Hub and nozzle united with solder, cross-sectional view.

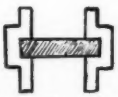

Fig. 5.—Cross-section showing two wax ribbons mounted on one graphite rod.

place owing to the presence of bubbles, these can be removed by using a threaded tap.

The next step is to cast a tip or nozzle having a bore of the desired cross-sectional form. First, obtain a model of the attachment which has been thoroughly checked for fit, size, etc. Oil this, and melt wax around it so that a flat disk is formed, with the attachment in the center (Fig. 3). The attachment is now carefully removed from the disk, and two sprues are attached, invested and cast. In investing this, special care must

be taken to fill the imprint of the attachment properly with investment material. This is best done by filling the recessed portion with portions of investment and blowing through with a chip blower.

When a satisfactory casting has been obtained, the orifice is painted with antiflux, and the previously made hub is joined to it with solder (Fig. 4).

We are now ready to make the wax ribbon. The syringe is filled with casting wax, preferably medium or low fusing. The nozzle is screwed on. The barrel of the syringe is now warmed, either in the flame or in hot water, which I believe is preferable. As the wax is cooling, the plunger is gradually forced down, expressing the desired ribbon.

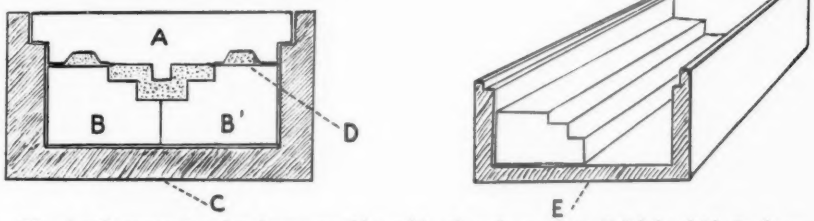

Fig. 6.—Cross-section showing separable mold. *A*, male portion; *B-B,'* fitted blocks forming female portion; *C*, external housing; *D*, escape way for excess wax; *E*, another view of mold partially dissembled.

This should be laid flat on a glass slab as it is formed, cut into sections suitable for casting (approximately 2 inches) and checked against the wire which it is intended to fit. The wax ribbon is now carefully invested and cast. I have obtained the co-operation of the manufacturers in producing graphite rods of certain gages. The graphite rod can be placed in the slot or channel of the wax ribbon, and then invested. This practically eliminates the possibility of a faulty casting. If care is used, one graphite strip can be used for two castings (Fig 5).

It is advisable to use a high fusing casting gold so that attachments can be readily soldered and unsoldered without danger of melting.

The casting is tested for fit, polished and cut into brackets of the desired width with a fine jeweler's saw. The end can be finished with a flat file before cutting, in order to produce a neat attachment.

MOLD METHOD

Another method which can be used to form the wax ribbon is as follows: A metal mold of two, three or more parts is made, which, when filled with wax, will give a ribbon of the desired form. Such a device is shown in Figure 6. The wax is melted or warmed and placed in the lower half of the mold marked *B* and *B'*, which has been previously lubricated. The upper part of the mold, marked *A*, is placed in position, and forced to place by using a wooden vise, expressing the excess wax. After cooling, the mold is opened and the wax ribbon removed. The carbon rod is inserted as before and the casting made.

ADVANTAGES

1. The principal advantage of attachments made in this manner is that they are more rigid and durable than when manufactured of wrought or drawn ma-

terial. By using casting alloys of high strength and high melting range, this advantage of durability can be realized to the utmost.

2. The property of durability gives rise to another advantage, namely, economy. The attachments can be used over again and are very inexpensive to construct.

3. Furthermore, should they be desired, attachments of varying length can be cut to suit.

The principle of forming attachments of various kinds by the technic described is offered with the hope of stimulating the evolution of new forms of attachments, as well as the wider use of those that we now have.

AVERTIN AS AN ANESTHETIC IN ORAL SURGERY: PRELIMINARY REPORT

By R. L. ROBINSON, D.D.S.; R. S. LLOYD, D.D.S., B.S., and W. W. HAMMOND, M.D., A.B., Baltimore, Md.

OBSERVATIONS made in many hospitals throughout the country show that avertin has been used either as a basal, or occasionally as a total, anesthetic for practically every type of surgical procedure. The number of contraindications during the last three or four years has steadily grown smaller. Even hepatic and pulmonary disease, unless severe, is no longer considered an obstacle to administration of avertin. The postoperative complications that can be attributed to it are practically nil. For this reason, we have not hesitated to use it in even minor surgical procedures, regardless of other existing pathologic conditions. It is extensively used in general surgical work here at the U. S. Marine Hospital in Baltimore.

In the last year and a half, avertin has been employed with marked success at this hospital as an anesthetic in oral surgery, primarily for full mouth dental extractions. The results have been so favorable that we feel justified in reporting five selected cases out of the first twenty. Every patient admitted to the hospital is given a routine physical examination and a detailed dental examination. When full mouth extractions were advised, the patient was informed of the various types of anesthesia available. The majority selected avertin anesthesia.

The usual procedure is as follows: On the evening preceding the day of the operation, the patient is given 10 grains of barbital by mouth and soapsuds enema. On the morning of the operation, another 10 grains of barbital is administered and the enema is repeated. The avertin solution is then injected rectally about one-half hour before operation. The dosage used varies from 60 to 100 mg. per kilogram of body weight. About thirty minutes after the administration of avertin, the patient is sufficiently well relaxed to allow the operator to proceed. A mouth prop and throat sponges can be inserted without difficulty, for the muscles of the lower jaw are relaxed and the pharyngeal reflex is lessened sufficiently to allow

the packs to remain in place. The operator is now able to proceed without haste and thus can complete the necessary operation more satisfactorily.

A number of advantages and a very few disadvantages are evident when a comparison is made of the results obtained with avertin and those obtained with an inhalation anesthetic or a regional nerve block. It has been noted that the operation can always be performed with much less difficulty. There is no need for speedy work. In fact, the patient is decidedly more quiet and relaxed when the teeth are extracted slowly. There is no mask in the way, no worry about the depth of the anesthesia and no vomiting either during the operation or later as so often happens in the case of an inhalation anesthesia. Sponges can be kept in the throat to prevent the aspiration of blood or tooth fragments. The patient can be placed in a dorsal recumbent position with the head lowered slightly and aspiration can be used easily, the operator thus being relieved of worry about postoperative pulmonary complications.

In regional nerve block, a pressure or chemical irritation sometimes results from the injection. Also, the site of injection may become the seat of an abscess owing to the contaminated condition of the mouth. After the effect of the epinephrine has ceased, the temporary vasoconstriction ceases and there is a fair incidence of secondary hemorrhage. With avertin, there is no local effect.

Furthermore, because of the prolonged sleep and ensuing analgesia after an operation performed under avertin, a good start in the healing process is insured by elimination of irritation to the recently formed blood clots. It is well known that a tooth socket will heal much faster and with less chance of infection if the amount of saliva is small. It has been observed that this condition prevails when avertin is used, for it eliminates conscious stimulation of the salivary gland. No case of "dry," that is, infected, socket was noted. Examination two or three days after operation showed the blood clots to be well organized and the gums in good condition, and healing was satisfactory.

Avertin anesthesia requires a short period of hospitalization, which might be objectionable in some instances; but it is felt that the advantages listed above far outweigh this single disadvantage. Indeed, as one surgeon remarked after observing several cases during and after avertin anesthesia, "The patients seem to look back on the operation as a pleasure rather than as a horror."

The following five cases are presented to show variations in the dosage, in the presence of systemic pathologic conditions and in the typical results obtained.

REPORT OF CASES

CASE 1.—K. M. J., aged 29, a white man weighing 155 pounds, was admitted to the hospital, May 29, 1933, for treatment of chronic active pulmonary tuberculosis. On dental examination, as his teeth were found to be badly involved with caries and periodontoclasia, a full-mouth extraction was advised. June 9, after the necessary preliminary procedures, avertin was given in a dose of 84 mg. per kilogram of body weight, a total of 5.8 c.c. of avertin fluid. The patient showed only a very slight reaction to this amount of avertin. He remained fully conscious and boasted of his ability to consume huge quantities of alcoholic liquors. An additional 1.2 c.c. of avertin fluid was then administered. The patient then became sufficiently anesthetized to allow the operation to proceed, and the teeth were extracted. On returning to consciousness a few hours later he said that he felt fine and wished to get out of bed. This he was not permitted to do. No postoperative involvement was observed and the gums healed normally. Some time later on being questioned concerning

his reaction to the entire procedure, the patient said, "If I ever had any more teeth to be extracted I would certainly want it done the same way." He also stated that he had not had a pain or an ache afterwards and that he partook of nourishment the same evening and observed only slight bleeding. In his opinion, this was an ideal type of anesthesia.

CASE 2.—M. H. C., aged 38, a white man, was admitted to the hospital, Feb. 18, 1932. A diagnosis of general paralysis (paresis) was made. On dental examination, the teeth were found to be carious and extensively affected by periodontoclasia, and a full-mouth extraction was advised. This was not performed immediately, for the patient was undergoing extensive antisyphilitic treatment. In the meantime, an additional diagnosis of diabetes mellitus was made. April 25, twenty-two teeth were extracted. Avertin fluid, 5 c.c., was used as an anesthetic. This represented a dose of 60 mg. per kilogram of body weight. The patient returned to the ward conscious, but fell asleep immediately and slept for three hours and at intervals for over eight hours. No postoperative effects were observed.

CASE 3.—W. S. R., aged 59, a white man, weighing 150 pounds, was admitted, June 7, 1933, for treatment of squamous cell epithelioma of the lower lip. On dental examination, it was found advisable to remove the remaining teeth because of periodontoclasia and irritation due to the pathologic condition of the lower lip. June 14, avertin, 100 mg. per kilogram of body weight, was administered, a total of 6.8 c.c. of avertin fluid. The operation consisted of cauterization of the lower lip and removal of five upper anterior teeth. There was no postoperative nausea or vomiting and the patient slept the remaining portion of the day. He later stated that he had no recollection of the operative procedure.

CASE 4.—J. E. G., aged 27, a white man, was admitted Dec. 2, 1931, for a third course of antisyphilitic treatment. On dental examination, his teeth were found to be badly affected by caries and periodontoclasia. Eight teeth were extracted and an alveolectomy was performed. The patient requested that the remaining teeth be extracted under avertin anesthesia. This was done, April 25, 1932. The usual preoperative procedure was followed and 3.5 c.c. of avertin fluid, 60 mg. per kilogram of body weight, was used as an anesthetic. He returned to the ward anesthetized and slept most of the remaining day. No postoperative reactions were observed and the gums healed normally.

CASE 5.—B. T., aged 25, a white man, weighing 142 pounds, was admitted, May 17, 1933, for treatment for an old ununited fracture of the left mandible. It was found advisable to perform an open reduction of the fracture. Avertin anesthesia was chosen because of reports that it depressed the vomiting center and because it permitted free access to the field of operation. May 24, a dose of 100 mg. of avertin per kilogram of body weight was given, a total of 6.5 c.c. of avertin fluid. Bone grafting was done. During the operation, avertin had to be supplemented with nitrous oxide. The operation was successfully completed and fixation of the mandible obtained. There was no postoperative nausea or vomiting, and the patient slept up to 9 p.m. Later, he stated that he considered avertin anesthesia the best from his standpoint, his previous experience including operations under nitrous oxide, ethylene and ether both by inhalation and by rectum.

CONCLUSIONS

In this series of cases, we found that avertin anesthesia had certain advantages in oral surgery because:

1. It did not interfere with the field of operation as do masks.
2. There was no postoperative nausea nor vomiting.
3. The necessity for haste in operating was eliminated.
4. The anesthesia and the postoperative analgesia were satisfactory.
5. The patients generally agreed that avertin approached the ideal among anesthetics.

AN UNUSUAL TABLE

By JOHN ROGERS MERRILL, D.D.S., Paris, France

THAT an unusual table such as is shown in the accompanying illustration is sometimes interesting to even established practitioners was proved when this table was shown at the Eighth International Dental Congress in Paris.

The idea of this operating table came to mind during the World War when the designer was detached from Mackay Roosevelt Hospital in France and was serving the eighteenth infantry, where only boxes were available for furniture.

Now his private office enjoys a breadth that permits an alinement of washstand, operating table, chair and roentgen-ray apparatus, with free space between each two. The operator has full freedom on his side while the assistant has complete access at all times on the rear side of the table.

An unusual operating table.

Two wall cabinets contain trays with sets of instruments which are the complement of this table.

The room and table are free from dust since the fresh air is forced, and passes through window boxes which have oiled plates. These filters remove both fine dust and soft coal flakes.

The table design might well be studied by American dental furniture makers, among whom standardization is so general.

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Editorials

THE ESSENTIAL INEQUITY OF PUBLIC ADVERTISING BY PROFESSIONAL MEN

In view of all that has been written on the subject in our periodical literature, it would seem hardly necessary to further dwell on the inequity of advertising.

Ever since dentistry began to assume a professional status in the eyes of the world, a sharp line has been drawn between advertising by dentists and advertising by business men, and sometimes it has been difficult to persuade the public that this difference was justifiable. Particularly among newspaper publishers, there has been on occasion a more or less mild rebellion against the operation of that part of our code of ethics which says that it is unprofessional for a dentist to advertise in the public prints. This objection is natural in view of the fact that to eliminate advertising reduces to that extent the revenue of the publishers.

But to their honor, the large majority of the newspaper men have quite generally come to recognize that the welfare of the people is

paramount to the accumulation of a few more dollars for the publishers, and certain of the newspapers are already going so far as to refuse to accept advertising of this character.

Let us consider for a moment the difference in the propriety of advertising on the part of the business man and on the part of the professional man. To advertise a product is an entirely different thing from advertising a person. The business man advertises a commodity, the professional man advertises himself. There is no escaping this distinction. It may be perfectly legitimate for a business man to advertise his goods provided he does not misrepresent them, but there is an essential incongruity in a professional man heralding to the world that he is a better man than his fellows of the same calling. It is impossible for the dentist or physician to advertise in a public way without ostensibly proclaiming to the world that he is possessed of superior qualities, and thus the manifest immodesty of such a procedure must be apparent to everyone. Not only that, but, as a matter of plain fact, there is usually an element of direct dishonesty in a professional man's lauding his ability before the public for the very patent reason that, as the case ordinarily works out, it is the man of mediocre or limited ability who finds it necessary to resort to advertising. So much is this the fact that even the public, particularly the intelligent public, are beginning to look with suspicion on the advertisements of physicians or dentists.

One of the chief evils of this kind of advertising aside from the general demoralization of the procedure relates to the well-observed fact that when a man in professional life elects to advertise in public, he invariably begins to distort facts in the most flagrant manner, and this distortion of facts usually assumes such proportions as to be a direct menace to the welfare of the people. It is bad enough to deceive the public as to the character or value of the commodities of every-day life, but usually the injury or injustice done by such deception is confined to a material or monetary loss. This, while unfortunate and irritating enough, is not so disastrous or distressing as the damage that may be done through false propaganda by professional advertisers. Misleading the public with respect to their physical welfare may well become a serious

menace, and particularly in the field of quack medicine, it has frequently led to the marring of a human life.

How much harm has been done to innocent and unsuspecting people through this medium can never be computed, and the damage that may result from fake advertising in dentistry is only one step less in degree. There seems to be an uncontrollable tendency to misrepresent facts as soon as a physician or dentist elects to advertise in the public prints. And this misrepresentation is usually not confined to a mere matter of exaggeration: it ordinarily goes the full length of falsehood, and falsehood is not a salutary thing to be ladled out to the public.

No wonder that in some of our legislatures laws have been passed prohibiting advertising of the sort just indicated. It is done, or should be done, wholly in the interests of the public, and this is a fact that may well be stressed on every occasion. The object of all legislation is to safeguard the people. Sometimes we hear the remark that certain laws are being advocated for the protection of the profession. Any law that is written solely for the benefit of the profession is unworthy of support by the better element of our citizens, even by professional men themselves. It is not supercilious to remark that the profession should be able to take care of itself in this regard. If the profession cannot justify itself in the eyes of the people by loyal service honestly and conscientiously performed, we should no longer be classed as being possessed of professional status. It is only when the people are menaced that we need laws for protection, and this fact is rapidly being recognized by thinking men and women, in the profession and out of it—in our legislatures and out of them.

To this extent, our civilization is advancing. How far would we have gone even a few years ago with the average legislature—with any legislature in fact—in advocacy of a law prohibiting advertising of this characture in the public prints? Not very far, my masters! It was only when our legislators became convinced of the essential inequity—we had nearly written it iniquity—of such practice that they waked up to the propriety of passing these protective measures to safeguard the welfare of the public.

And in connection with this legislation, a word should be said

at this time in commendation and congratulations to the splendid men and women who labored so hard and unselfishly when these measures were under consideration. The honor should go not only to members of the dental profession, but also to the loyal and wide-visioned members of the legislatures who did yeoman service on behalf of these advanced ideas.

Legislation of this character having in view the better protection of the populace is constructive in every way, and a credit to the common sense and acumen of those who sit in our legislative halls. More power to such legislators!

THE MEMBERSHIP CAMPAIGN

On another page will be found a letter from the Committee on Organization and Membership of the American Dental Association This letter explains the plans of the drive for increased membership, and we trust that every word of it will be read.

Manifestly, the most important and insistent demand of the hour in our Association is a larger membership, and this the Committee realizes to the fullest extent, and with the deepest understanding of the situation. Increased membership, as the Committee intimates, means greater efficiency in every avenue of our Association activities. There is really no reason that we should not have a membership of 50,000, and if the present plans are carried out to the letter, we shall soon approach it.

Already the membership is increasing in a very encouraging way. We are much ahead of the number that we had at this time last year. In some sections, there is a very notable increase, and the prediction is confidently made that when the membership campaign is fully under way, we shall see such a stimulation of effort all along the line that the slight loss that was sustained during the depression will be more than made up, and we shall be a stronger organization than ever.

In certain districts, notably in Michigan, the membership has now been brought up to 100 per cent of the eligible men and women of the profession. How was this fortunate condition brought about?

In several ways. First, there was the manifest fact that the Association offers a more diversified service and an altogether wider order of benefit than can be obtained in any other way for a similar amount. Think of it. For the $4.00 that is allotted to the parent body, there are turned back to our members rights, privileges, service and protection that could be obtained in no other way. These benefits have repeatedly been enumerated, and full information as to the varied activities can be obtained for any group or individual by applying to the Central Office.

But the real way to approach prospects with the greatest assurance of success is to do as the Michigan men and similar successful groups have done; i.e., through the medium of personal appeal. A practitioner may receive a letter in the mail outlining the desirability of membership, and it may impress him with its logic and its unanswerable argument. He may at the moment resolve that he will join the Association, and, as a matter of fact, he intends to do it at the earliest opportunity. But alas for human nature! he allows other distractions to come along and divert him from his purpose; his application is permitted to go by the board, and he follows the line of least resistance and drifts along without membership.

But it is an altogether different matter when one of his fellow practitioners who is a member, or better, when two or more members call on him personally, take him by the hand and make an intimate and personal appeal. Down deep in his heart, he likes the interest they are taking in him; there begins to glow in his heart a fellow feeling, and he is something more than human, or rather something less than human, if he fails to respond in some way to an appeal that is so intimate and humanitarian.

Good fellowship is one of the essential attractions of membership, and the new prospect is at once impressed with its possibilities as he sees other men of his own calling inviting him to affiliate with them on a common basis of comradeship and fraternal regard.

This organization of ours is one of the great moving and vitalizing influences for good in our profession, and no ethical man can afford to remain out of it. Let us work for 100 per cent eligible membership, and reap the benefit of what this would mean to all of us.

THE EMERGENCY RELIEF PROGRAM

At the recent meeting of the Board of Trustees, the Special Committee on Dental Economics, consisting of E. H. Bruening, John T. Hanks and Harold Oppice, made a report on the Emergency Relief program. We cannot do better than to quote liberally from this report, embodying as it does the salient points of the present situation.

"In the Bulletin known as 'Rules and Regulations No. 7' there has been set forth the need for Medical, Dental and Nursing care."

The plan of the committee is to arrange with the Federal administrator in Washington for joint committees on medical and dental relief in each state, to be known as the Joint Committee on Emergency Health Service. This joint committee shall consist of a representative from the following societies: state medical, dental, nursing and pharmacal and the Federal Relief Administrator. These will cooperate with the local Federal Emergency Relief Worker.

The A.D.A. committee has compiled reports from nearly all the states in the Union. Naturally, there are differences in plans of administration, as well as in the fee schedule submitted.

The committee recommends that eligibility for dental relief service be confined to those entitled to relief under Federal regulations; that responsibility for administering relief be assumed by medical and dental societies, and that the scope of service be relief from pain, examination, including x-ray, prophylaxis, fillings, extractions and repairing dentures.

The authorization of service is to be made by the local relief officer at the request of a designated dental examiner.

"Emergency fee schedules have been received from a number of state and local societies, some of which have been approved by the State Federal Relief Administrator. These are available to societies who may want this information."

This special committee has worked very hard to formulate some system whereby the present emergency may be met on the part of our profession. In any enterprise of this character, whether the emergency consists of a sudden calamity such as fire, flood or an

acute depression, the dental profession may always be counted on to do their full duty, and in the present instance we feel that the problem has been placed in most competent hands.

THE NATIONAL BOARD OF DENTAL EXAMINERS

That very worthy enterprise, the work of the National Board of Dental Examiners, is progressing most satisfactorily, and the profession in general, and our educators in particular, will find much of interest and profit in the reports that are being made of each examination.

The National Board held its second examination in Part I, Friday and Saturday, Dec. 8 and 9, 1933, at eight examination centers. There were forty-five candidates divided as follows: at Boston, Mass., two candidates, one from Harvard and one from Tufts, both students; at Pittsburgh University, ten students; at Baltimore, University of Maryland, six students; at Washington, D. C., Georgetown University, six students and two naval lieutenants, both graduate dentists; at Richmond, Va., Medical College of Virginia, seven students; at Philadelphia, Temple University, two students and one graduate dentist; at Iowa City, State University of Iowa, five students; at Minneapolis, Minn., University of Minnesota, four graduate dentists.

With the first year of the National Board activities, we find that 128 candidates have taken the Part I examination, eighty-three in May, 1933, and forty-five in December, 1933. The Board will hold a Part I and a Part II examination on May 25 and 26, 1934. From the growing interest displayed, our National Board is anticipating that the eight examination centers just mentioned, together with Chicago, will be augmented by several new ones and the largest class of candidates to date be examined.

Applications, accompanied by the fee, should be in the hands of the Secretary, Harry W. Nelson, 1747 Medical Arts Building, Minneapolis, Minn., not later than May 10, 1934. The fee for the Part I examination is $10, and for Part II is $15.

Of all the movements tending to the reciprocal idea in dental

licensure among the different states in the Union, this one of the National Board seems to offer the best solution. It is the first concrete and unified effort to work out a solution that may be made available to all sections of the country, and to the graduates of all approved schools. Every possible encouragement should be given to this movement, not only on the part of those most intimately interested in its operation, but of the profession at large. It concerns every practitioner of dentistry in this country, and what concerns every dentist concerns as well the rank and file of our citizens.

AN ATTRACTIVE VACATION IDEA

Many of our members will want to plan their vacation immediately after our meeting in St. Paul in August, and the Committee on Local Arrangements is making every effort to gather information of special interest to fit the plans of all of our members.

Every conceivable kind of vacation may be arranged within easy distance of the meeting place, and the members of the Committee are only too anxious to furnish specific information on any phase of the question.

There is probably no other region of the country that abounds in such facilities for a convenient, a comfortable and an economical vacation as does the region around St. Paul. The district abounds in lakes of all sizes, literally thousands of them (estimated at 10,000), so that every man may have his own lake if he wants it. There are all sizes of lakes and all shapes of lakes, and all depths of lakes.

And the accommodations are as diversified as are the lakes. You may have the most pretentious de luxe private lodges and be lord of all you survey; you may have the modern and not so modern hotels; you may have a modest cabin tucked away out of sight in the woods, and carry your own drinking water and firewood; you may tote your own tent pole and camp out—no, you will not even need to carry a tent pole, you may cut that out of the woods any place; you may roll up a blanket in a shawlstrap and sleep under the stars, and they do say that they have the brightest stars to be seen anywhere

in the world; you may even dispense with a blanket and snuggle down in the pine needles and dry leaves, and—but no, you really need a blanket—the nights in this region are quite cool even in August.

There is one thing you should do: Be sure to take plenty of food, because you will be hungry most of the time. On second thought, you will not need to take so very much food, particularly if you like fish, and everyone likes the kind of fish they catch in these lakes and rivers. All you need to do is to take a piece of string and a bent pin with a bit of red flannel tied to it, and catch all the fish you want.

If this description seems in any way overdrawn, you are respectfully referred to the Committee on Local Arrangements who will verify every statement, and add many more to it of an authentic nature. The members of the Committee are more than anxious to supply you with all information and render you every assistance in arranging your vacation. The chairman of the Vacation Committee is Dr. Orville J. Merwin, 364 Lowry Medical Arts Building, St. Paul, Minn., who will answer all enquiries. Write him at once, and you will hear from him promptly.

THE HOME STRETCH

The real test comes in the struggle at the home stretch. Other things being equal, the race is won by the burst of speed that is put on during the last few strides. Stamina is one of the things that count, the thing that is needed to carry through and maintain momentum to the end.

There are many of our dental students of today who are entering the home stretch of their college course. Through long years of effort, they have striven toward the goal, and in a few months they will meet the final test and reach the post.

What then? Even if they succeed in passing the post in acceptable form, they are not through. The race for professional preferment is always beset with difficulties. Immediately after graduation, they encounter a hurdle—the state board. And frequently this is the most fearsome obstacle of all up to this time. The state board

license is naturally the goal of every student, the *summum bonum* of his ambition. From the time he enters a professional school and takes his first test to the home stretch of his college course, he has in his mind this same state board license. And why not? It is the ultimate of his student efforts, the insignia that proclaims to the state officials and to the world at large that he is qualified to serve the public in the capacity of a dental practitioner. That state license means something to the community, or at least it should. To the student, it means everything. It is the answer to all of his weary plodding, and the days and nights of application to the various problems that confront a student in a college course. It is a compact between the state and the student signifying that the citizens of the state may be acceptably served in a dental way through the medium of the knowledge gained by the student in college.

At every state board examination, there is tendered to the community, through the recent graduates, an acquisition of available dental material on which the citizens may draw in fulfilment of their dental needs. Each year a certain number of graduates are required to meet the demands for new practitioners; each year the ranks are depleted by death or by other exigencies that call for constant recruiting.

To supply the loss thus sustained, we need a certain percentage of newcomers in our ranks, and if the attitude of the profession and the people measures up to what it should, these same newcomers are made very welcome. It is the fresh blood that vitalizes the profession and keeps up a healthy circulation in professional life. We need these young men and women as they enter our ranks, and we glory in each new achievement they make. One of the most interesting studies in a dental career is to note the development made by the new recruits. There is always promise in every graduating class that something rare and stimulating will accrue to the profession as the result of the annual acquisition of new practitioners. Students are better trained today than ever, and the science and art of dentistry is broadening to make a more insistent demand for the cultivation of new talent among the graduates. The curriculum is broader and more comprehensive, and the exactions are altogether greater than formerly. All of this tends to a better preparation for the neo-

phyte, and the result should inevitably be more competent men and women in our dental ranks.

It must thus be recognized how important is the training given our boys and girls in a dental school. How necessary it is that their sensibilities be stirred to the highest pitch during their college days, that their incentives be cultivated, their ambition aroused, and their perceptive faculties stimulated by the closest application to the problems that must inevitably be presented to them when they get out to practice. We might almost say that the student should be put under more or less pressure in order that the best there is in him shall be brought out during his college training. With some students, this pressure may not seem necessary, but with many of them it is, and it may be considered conservative to suggest that in very few instances do we find students who are not benefited by a certain amount of forcing during the course. The fact that so large a percentage of the entire student body ultimately qualify for graduation and state board licensure is proof positive of two things—that a great deal of effort is expended on the part of the teachers, and a great deal of application is displayed on the part of the students.

In this view of the case, there is cause for congratulation; not that any one will assume that the present status of teaching in our dental schools is one hundred per cent perfect, or that the product that is turned out is in all respects satisfactory, but that as compared with the ordinary enterprises of life, we have little reason to regret the results.

In a very few months from the present moment, an appreciable number of young men and women will approach the wire for their final test of training, and we cordially wish for them the consummation of their fondest hopes, the ultimate success for which they have been striving for years. And at this time, we would again remind them that a great deal depends on the effort they put forth as they approach the winning post. In other words, it is the home stretch that counts.

A NEW DEPARTMENT

It has been felt for some time that a department in our JOURNAL was needed for the presentation of brief items of a practical nature consisting of a paragraph or two. The busy man, and particularly the man of intensely practical leanings, can be reached only by the publication of material that is not verbose, and that tells a story of every-day practical value and tells it in the fewest possible words.

A paragraph will frequently convey an idea to the busy practitioner that he can utilize to advantage at the chair or bench, and these aids may do much to help lighten the load of daily profssional life and make more efficient the practical service that every earnest and honest dentist wants to render to his patient.

The department, to be known "Practice in Paragraphs," will begin in our next issue. Each item published will be written and signed by the author, and will be as practical and brief as such items can be made. We cordially invite contributions of the nature indicated from any or all of our members, and we promise to devote every atom of our energy to make the department of the greatest interest and value. For the successful operation of this enterprise, we need the hearty cooperation of our members. Whenever a practical idea occurs to you, jot it down and send it in. We shall have need of all that can be provided, and we shall be correspondingly grateful for every item contributed. The length of the contributions, while not rigidly circumscribed, should not ordinarily exceed 200 words. We do not solicit long articles for this department.

THE SCIENTIFIC PAPER

Papers that purport to be or are scientific often provoke a curious "Why?" on the part of readers. Why all the introductory history? Why all the cuts? Why all the bibliography? Why the repeated anatomy of parts? Why the detailed steps over well-known, oft-traveled ways? Why the rewriting and reprinting of standard textbook material in support of what is presented?

These questions might be said to apply to beginners only, with the

explanation that the establishment of authority and a display of erudition are the objectives, that at an early age these writers may have the smell of old books upon them. But that is not true. Men who began to write a long time ago succumb to the same weakness whatever the cause may be and the cause can scarcely be the same in their case. It might partake of the first objective to the degree that authority must be established. Readers familiar with the authors' names won't suspect them of "learning's pride" or other pretense. Perhaps such writers suppose that their readers are uninformed, need to be built up to reach the new height ahead. Writers should be certain on this point: it might save them much toil and somewhere en route much expense.

It is reasonable to believe that men interested in a given subject, interested enough to select it from a book full of reading or to seek out a room where a paper on it is to be read, a room among twenty, brings with him understanding and information enough to grasp the findings to be presented without having the alphabet dinned at him until he is weary before he learns why the speaker is on the platform. Such an auditor has developed his interest before coming in or he would not be there. Hearers and readers do not choose special addresses or articles on a whim or to fill an otherwise empty hour.

The same applies to cuts and photomicrographs. Ordinarily and oftener, a man will pass by the article having bacteriologic, pathologic or histologic displays unless he knows enough about them to do without a half that are printed these days. The old familiar sections from textbooks he knows. He became acquainted with them when the author did probably, or before even. The basic tissues and their relations he knows and so does not need to have depicted.

The principle applied to other departments operates similarly: If he did not know the basic facts, he would not be interested in the new ones. It is clear that bacteriologist writes for bacteriologist, pathologist for pathologist, prosthetist for prosthetist. And such men do not care for the grammar of their trade. They want the new literature of it.

Bibliographies provoke the same suggestion. Why repeat end-

lessly the name and place of author, the date of publication? Will the time never come to stop bibliographing Mayo's prophecy and Hunter's condemnation? Visualize the bibliography as it is now built a few years hence! It has to stop sometime—not the essential support bibliography gives to a theme, but the nonessential—and why not now? Why not assume that a man who took a course under a Hatton, a Bunting, a Wright, an Appleton, has gathered enough knowledge to be spared the fatigue of repetitive reading, to know how history speaks in general terms and confine bibliography to the recent and specific?

Perhaps worse than any of the foregoing is the extended bibliography, units of which are not mentioned in the text. Such compilations attest nothing to the extent either of personal effort or of scholarship. Ways of obtaining them are too obvious. If an addition of a few references is thought necessary to guide a student's pursuit, a suitable note may indicate the purpose and extend a service. The more definitely a man explores new fields, the more rapidly references decrease. If a long list of names are quoted, the indication is strong that the writer is treading familiar ways.

And, speaking of this matter of coming to the point: Readers and writers would have more alert audiences. More speakers could be put on programs and more articles be printed in books. Likewise, the student who seeks meetings to learn and magazines for things that are new would go away with a richer fund of information. Also he would not mutter imprecations on the scholar who has assumed that he has to be retaught the fundamentals in order to understand. He is not complimented and he knows it. To the point also: In these days, dentists are coming from our schools with such knowledge of the rudiments and of the ancient authorities.

T.

THE MEMBERSHIP PLAN

To Members of the American Dental Association:

The Committee on Organization and Membership has been working for over a year on the preliminary arrangements necessary for the inauguration of the carefully worked out membership plan. During this period of preparation, the proposed plan

has received the unanimous approval and pledge of cooperation from the American Association of Dental Schools and the National Association of Dental Examiners and has been modified in accordance with the recommendations of the State Society Officers Conference at its annual session in August, 1933. By subsequent action of the Board of Trustees and the House of Delegates, the amended A.D.A. membership plan was approved in its entirety.

As more than the required number of constituent state dental societies had approved the official membership plan, the Board of Trustees at its mid-winter session, Feb. 24-25, 1934, officially authorized the inauguration of the first annual membership contest for March 1, 1934.

The Organization and Membership Committee earnestly requests every member of the American Dental Association to consider himself a member of the committee to make effective this important activity. The service of every department of the A.D.A. will be benefited by an increased membership. Let each member visualize to himself what 50,000 dentists could do working together for the realization of the high ideals of the profession and the more effective service to the public.

Members are requested to adjust their personal efforts in accordance with conditions of the communities in which they reside. Frequently, better results will be obtained by inviting a dentist from a neighboring community to make a plea to the local nonmembers than could be achieved by a dentist of that locality. A plea is made to each member to exert himself to get at least one new member.

The officers of the respective constituent state societies with their district component units will be kept informed of the general method of procedure and be supplied with the necessary material from the Central Office of the American Dental Association. Any information desired by any member will be gladly given, and each member is requested to give his loyal support and personal service to the end that not only shall the membership of the American Dental Association be increased, but also his own state society may make a commendable showing in the percentage rating achieved by the different constituent societies.

Earnestly soliciting the cooperation of every member of the American Dental Association in this fundamentally invaluable project, we subscribe ourselves,

Respectfully,

ALBERT R. ROSS, *Chairman*
H. B. PINNEY, *Secretary*
FRED D. MILLER
JOHN SCHOLTEN
C. B. WARNER

Obituaries

ALFRED ONIAS HUNT, D.D.S.

(1845-1934)

Alfred Onias Hunt was born in Utica, N. Y., Feb. 27, 1945, the son of Dr. J. Hunt, a physician. He was educated in the public schools and the Utica Free Academy where he was attending the final course when, in 1858, rumors of the Civil War filled the air and no one could make any definite plans for the future.

As he wished to be a dentist, his father suggested that he continue his education under the ministrations of tutors with definite hours and no vacations and that he himself would act as tutor for medicine and surgery. Arrangements were then made with Professor Hatton, his former instructor in chemistry and metallurgy, as tutor for those subjects. Dr. H. R. White was secured as tutor for dental science and practice and later became Dr. Hunt's preceptor and partner in the practice of dentistry. Drs. Allport, Westcott, Blakesly, Foster and others came to Utica twice a year for the study of dentistry, a new idea in those days, and Dr. Hunt received the benefit of their knowledge and experience.

In 1860, Dr. Hunt devised five pairs of forceps for extracting teeth. Up to this time, extracting was mostly done with the turnkey. Hunt pattern forceps are on the market today, as are a number of different instruments and appliances invented by him.

In 1861, Dr. Hunt went to Syracuse, where he was associated with Dr. Westcott in the study of continuous gum work for one year. He then moved to McGregor, Iowa, where, July 15, 1868, he married Maria J. Church. He practiced in McGregor with his brother, C. H. Hunt, until 1881, when he with three other dentists founded the Dental College of the University of Iowa.

In 1882, Dr. Hunt moved to Iowa City and took up his work as secretary of the faculty and manager of the department of dentistry. He completed the regular course of study for the degree of doctor of dental surgery in 1883. In 1886, he was made dean of this department, holding this position until 1896. He was also professor of prosthetic dentistry and metallurgy during this time, and was the first man to teach crown and bridge work in an organized dental college (1882-1883).

During 1896-1897, Dr. Hunt was professor of prosthetic dentistry and facial art in the Chicago College of Dental Surgery. The next year, he accepted the position of dean of the Omaha Dental College, a department of the University of Omaha, acting in this capacity until 1906. Here he was also professor of prosthesis and facial art.

All his life Dr. Hunt was active in organizing and encouraging dental societies of all kinds, believing that when a man graduated from college he should continue his studies and that a dental organization is the best stimulant toward this end. He was a steady contributor to the literature of the profession.

In 1866, he was elected president of the Iowa State Dental Society. He was also president of the Association of Dental Faculties for two successive terms. From 1890 to 1893, Dr. Hunt served as secretary of an executive committee of fifteen

members who organized and conducted the World's Dental Congress held in Chicago during the World's Fair, and he continued as one of the Publication Committee until 1895. In 1899, he was elected president of the Odontological Society of Chicago. In 1904 was made a member of the International Dental Congress, and elected honorary vice-president of the Fourth International Dental Congress held in St. Louis. He founded the Odontological Society of Omaha.

Feb. 23, 1914, a testimonial banquet was tendered Dr. Hunt by the Tri-City Dental Society and the Odontological Society of Omaha. More than 200 dentists, physicians and surgeons from Nebraska, Iowa, Missouri, Kansas and other states attended.

Dr. Hunt retired from practice in October, 1923, after practicing for sixty years. His death occurred January 12 after a few days' illness. The widow survives.

CECIL L. BYERS, D.D.S.

(1878-1934)

After an illness of one year, Cecil L. Byers died at his home, 2138 North Illinois St., Indianapolis, Friday, February 23, at the age of 56. He had practiced at the Illinois Street address for twenty-five years.

Born in Warren County, the son of William F. and Phoebe M. Byers, Dr. Byers attended public schools in the county, after which he went to Indianapolis to attend the Indiana University Dental School, from which he was graduated in 1904. He joined the Indianapolis Society in 1912 and had been a continuous member of the component, state and national organizations since that time.

At the time of his death, Dr. Byers was secretary of the Indiana State Dental Association, the Indianapolis Dental Society, the Indiana State Alumni of the Psi Omega Fraternity and the Indiana chapter of that fraternity. He was also a member of Marion Lodge, No. 35, F. and A. M., Sahara Grotto, Nineteenth Century Lodge, No. 470, K. of P., the Imperial Order of Red Men and the Tabernacle Presbyterian church.

Funeral services were held at the Tabernacle church, the Marion lodge being in charge of the rites. Members of the Indianapolis Dental Society attended in a body. The burial took place in the Washington Park cemetery.

In addition to the widow, Hazel Lohmen Byers, to whom Dr. Byers was married in 1932, his mother and three brothers survive.

R. N. Douglas.

BUREAU OF PUBLIC RELATIONS

THE MAINTENANCE OF A FAMILY DENTAL PRACTICE*

By EDWARD J. RYAN, B.S., D.D.S., Evanston, Ill.

WITH the exception of the producers and distributors of the prime necessities of life—food, clothing, shelter—dentists have a larger potential market for their services than practically any other economic group. Whereas there are many persons who may go through life with only an occasional demand on the services of the physician, virtually no one escapes dental disease in some form. Comparatively few persons need make repeated calls on the services of the lawyer. Only occasionally does the individual person need the aid of the architect or the engineer; few of us at any time make such a direct professional contact—at most, once or twice in a lifetime. In the case of commodities and things separate and apart from the necessities, the potential market per person in the population is limited. But not so with dentistry. Of the 123,000,000 persons in the United states, it is conservative to say that 90 per cent, or 108,000,000, comprise the market for possible dental services. How well this market is developed; how many of these persons represent "effective demand," that is, desire plus purchasing power, is another story.

It would seem advisable, before we approach the more economic aspects of dental practice, that we reorient ourselves to the nature of the disease processes that we are treating, because in our case, the very nature of the disease has widespread economic connotations. For example, actinomycosis and Addison's disease are interesting and important pathologic processes, but they do not, because of their comparative rarity, have the far-reaching economic implications attached to dental caries and the common cold.

Whenever we are confronted with a disease the incidence of which is upwards of 90 per cent, we may safely call the condition a widely prevalent disease, if not universal. Apart from the extremely high incidence of dental disease, there are other factors that distinguish oral disease from any other. Dental disease in some form is practically unescapable. If it isn't caries in early life, it is pyorrhea in later life. If teeth are hard and well calcified, in time, under masticatory stress, they become abraded. Normal occlusion is then interfered with, the vertical dimension of the face is affected and another type of dental syndrome develops. Finally, if a person has been so fortunate as to escape caries, periodontal disease, abrasion, erosion and malocclusion, there is always the likelihood of accidental injury. It is easily seen, then, that modern man is definitely doomed to some form of dental disease and that in some form upwards of 90 per cent of the

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 11, 1933.

population are affected. Apparently, as man ascends the evolutionary scale, his dental disease moves up with him. Mechanization, technologic development, public health, engineering—these have pushed typhoid, yellow fever, the plagues, for instance, out of the pathologic picture. But dental disease apparently thrives on the civilization of wheels, internal combustion engines, radioactive waves, machines and gadgets.

It is a safe assumption that mankind will not give up the convenience and pleasures of the Machine for any bribe—even if we could offer as the bribe perfect and disease-free teeth. We are confronted, then, with what appears to be a fact at the present state of our knowledge; namely, that as technology advances, dental disease will increase with it. It is possible, to be sure, that somewhere, somehow, someone may solve the riddle of caries and periodontal disease, but we should warn aspiring scientists that unless the prevention is simple, sure and cheap, many of our people will pass it by. They will prefer, as they always have, to enjoy their pound of pleasure rather than their ounce of prevention. It is unlikely, from the evidence, that technology will ever produce unemployment among the dental profession.

Dental caries, aside from being widespread and almost universally prevalent, is a unique disease entity. First, it attacks tissue that has little or no power of self-repair. Beneficent Nature does not readily or frequently check a dental carious process. A cavity once, a cavity forever—and it usually becomes progressively worse. A bone fracture may go untreated and union may occur; soft tissue involved in inflammatory reactions may show a self-limiting power and heal spontaneously; but not so with dental caries. This disease requires the attention of a force outside and apart from the bodily mechanism. Secondly, a tooth attacked by dental caries has, it seems, no immunity against a second attack. Thirdly, dental caries, although principally a disease of childhood and early adult life, may attack both sexes at any period in life. Fourthly, dental caries is not a seasonal or geographic condition; it exempts no social class; it often attacks the scrupulously clean and careful person and exempts the dirty and careless. In short, dental caries is for all practical purposes a universal disease, apparently on the increase, and our services are required by more than 90 per cent of the population. How we may make our services available to this more than 90 per cent and how we may effect our own economic survival is a problem in economics that to date has not been solved.

In the publications of the Committee on the Costs of Medical Care, one often comes across the expression "adequate medical care." Throughout these publications, the word "medicine" is used in a comprehensive sense to include the private practice of physicians, dentists, nurses and all types of medical and public health agencies. In the year 1929, in the United States, more than 1,000,000 persons were engaged in all types of medical service, for which the American people spent $3,656,000,000, which is approximately $30 per capita per annum. For each dollar spent for medical services, 12.2 cents goes to dentists. In short, about $3.66 per person per annum was the average expenditure for dental care in 1929. Not all the American people, however, received dental care. In fact, says the Final Report of the Committee on the Costs of Medical care[1]:

> Among the mass of the population, only 21 per cent of individuals secure any dental care

1. Medical Care for the American People, Chicago: University of Chicago Press, 1932, p. 11.

during an average year. Undoubtedly, a certain proportion of persons secure care only for the relief of pain and other dental emergency. The proportion of the population who receive systematic and sufficient dental care must be considerably less than 20 per cent. The need for systematic dental care is unquestionable. That there is a latent demand for it is attested by the fact that the great majority of people in the higher income groups purchase a considerable amount of dental service. Probably over 60 per cent of the $445,000,000 expended annually for dentists' services comes from the 25 per cent of the population with incomes of $3,000 or more.

In the search for the definition of what constitutes adequate dental care, the words "systematic" and "sufficient" as used by the Committee on the Costs of Medical Care give us more than the clue. "Systematic" can mean only one thing: dental service performed with regularity; that is, the patient must be seen frequently and at regular intervals. The term "sufficient" means dental care of a type and quality to supply the needs of every person in the population. As a matter of fact, the Committee on the Costs of Medical Care has gone on record[2] without qualification as recommending that services to supply good dental care must be available to 100 per cent of the population over 3 years of age. This recognition of the importance and value of dental care may be better understood when we note the following recommendations of the committee for the amount of service needed to supply good medical care:

Health examinations, 94.1 per cent.
Immunizations, 18.5 per cent.
Refractions or glasses, 17.5 per cent.
Hospitalization of illnesses, 12.1 per cent.
Medical and surgical cases requiring x-ray, 18.6 per cent.
Cases requiring laboratory services, 58.1 per cent.
Dental care, 100 per cent of persons over 3 years of age.

We may define adequate dental care, therefore, as follows: Adequate dental care for the average family constitutes systematic attention and sufficient service to meet all the dental needs of 100 per cent of the population of the United States over 3 years of age.

It is true that this definition does sound utopian and visionary. It is equally true that with our present number and organization of dentists, we could not supply the dental man-power to give this type of adequate care. The lag that exists between the 100 per cent potential market and the 20 per cent effective market will not be quickly, easily or soon overcome—if ever.

The 24,400,000 persons,[3] or 20 per cent of the population, who spent in 1929 $446,000,000 for services from 56,800 dentists in private practice represent an average amount spent per person served of $18. On the basis of the dental expenditure representing 12.2 per cent of the amount spent for medical care, it would mean that for every person to spend $18 a year for dentistry, the annual per capita budget for medical care would be $147. Now if we take the usual conservative estimate of social workers for the average family as consisting of 4.4 persons, we find that the family budget per year for medical care would be, in round figures, $650, of which about $80 would be spent for dental service.

Could the average family set aside a budget of $650 per year for medical care? It is quite apparent that under the present economic order, it is impossible. Of 9,000 families studied by the Committee on the Costs of Medical Care, 74.4 per cent had in 1928 incomes of less than $3,000 a year.[4] It is ridiculous to con-

2. Footnote 1, p. 8.

3. Leven, Maurice, and Beck, Dorothy Fahs: Practice of Dentistry and the Incomes of Dentists, Chicago: University of Chicago Press, 1929, p. 209.

4. Footnote 1, table 6, p. 16.

sider that, in these families, a budgetary allowance of $650 a year, or more than 21 per cent of the total income per family, could be made for medical care.

To be perfectly fair in our interpretation, we must remember that about 20 per cent of the total expenditure for medical care is at present borne by governments, philanthropy and industry; while the costs of 80 per cent are met directly by patients. With this statistical adjustment, we would find that the average family budget would still call for an impossible outlay; namely, about $520 per year.

To be sure, we may argue, we might change the habit patterns of consumption whereby persons will budget 10 or 20 per cent of their incomes for medical care. We are told that we should make the public "dental conscious," "eye-glass conscious," "laparotomy conscious." We should exhort the public to buy inlays rather than infants' apparel; spectacles in preference to swank; a laparotomy before luxury. In theory, this sounds well enough, but we know that man, hedonist that he is, will usually budget pleasure before pain. It is true that we have gone a long way in the past century in cleaving biology free from superstition; we have made long strides in the education of the public in matters of disease and the meaning of health. But the road ahead is still long and tortuous.

In our zeal to impress the public with the importance and value of health and proper professional care, we must make sure that we are not seduced into the error of considering our services as commodities that can be sold over a counter. Dentistry should not scream its services over the radio; glare at the public from billboards; splurge in printer's ink. We may call it ethics, tradition or, better still, horse sense—but dentistry's greatest opportunities are in the maintenance and elevation of professional standards. As professional men, we will accomplish more and go farther than as Simon-pure business men. In this respect, Harvey Cushing,[5] with a long and illustrious career in the practice of medicine, has recently written:

> Even science has unblushingly begun to spread her experimental discoveries in the raw before the public. . . . And since everyone is doing it, how long will the doctors continue as a class to resist? When they no longer do, and adopt the advertising methods of those parasites of the profession, the quack and patent mediciner, God help the man of modest means and everyone else, whether below him or above him in the social scale, who may some day need a doctor.

How may the costs of adequate care be met? By the state, through taxation, says a Marxian group in the population. But they forget that raising monies from taxation merely means taking money from one man or group of men and giving it to another man or group. Some day, the giving group will get weary and no longer will they produce. They who produced wealth in turn reach out for governmental aid and subsidies. The pendulum of socialization begins to swing back toward individualism when the tax assessments are computed. The people themselves, in the final analysis, will probably prefer the personal relationship and individualism of private practice to the impersonalism of state medicine. In the control of banks and insurance companies, in personal and property protection, the public may prefer governmental supervision, but when the intimacy and privacy of their own bodily organism is involved, it is a safe guess that the public will prefer the system of private medical care.

Insurance for medical care in commercial insurance companies has been suggested. But even the utopian majority of

5. Cushing, Harvey: Medicine at the Cross Roads, J.A.M.A., 100:1571 (May 20) 1933.

the Committee on the Costs of Medical Care recognized the dangers inherent in a system wherein the professions would be under the domination of business. Whatever form group payment should take, and it seems advisable that some form of group payment in certain cases be adopted, the mechanism must be under the control of the professions. Finally, we must remember, as two dental members[6] of the Committee on the Costs of Medical Care pointed out, that "the problem of providing medical care is a question of low incomes and the solution depends at least as much upon increasing incomes to a satisfactory standard of living, as upon methods of organizing medical care." In brief, give the American people employment, satisfactory wages, economic security, and they can, for the most part, meet the costs of adequate medical care.

As we approach the more practical phases of this subject; namely, the opportunities of the general practitioner in maintaining a family dental practice, we may easily fall into mental error. We may weep in glorification of the general practitioner and by so doing forget the practical problems that confront him. But what is needed is realistic thinking with just the right touch of sentiment. Another possible error is to consider the practice of dentistry entirely as an exacting science and no part a genial art. Dentistry is concerned with biochemics and is in this respect a science; dentistry is also concerned with human behavior and in this respect is a genial art. A third error is for us to be always searching the horizon for the spectacular and the panacea for our economic ills. In this fruitless quest of wish-thinking, we are likely to ignore the obvious opportunities in our practices and be constantly reaching out for a cure-all that never comes.

6. Phillips, H. E., and Rudolph, C. E.: Minority Report No. 2, p. 184.

The events of the last few years have proved that most economic seers and prophets are charlatans; that a *new* technic in production or distribution is not synonymous with a *better* method; that success is still founded on the old foundation of honesty and right and fair treatment. Yes, I shall risk being called sentimental—the Golden Rule is still the safe measuring device for business and personal conduct.

Those who may expect some brilliant panacea to relieve them from their professional economic distress, I fear I shall disappoint. Any practical suggestions that I may make are obvious and easy to apply. I shall make no suggestions that would intend to change human nature. In short, I shall offer nothing new or spectacular; nothing impossible or untried. My earnest hope is that a different approach, perhaps, or another point of view on some of our obvious opportunities may be of some practical help.

From what base-line shall we start in the consideration of this problem? This matter naturally concerned me in the preparation of this paper. In the heat of early June, in the solitude of the country, one evening I pondered this point. I sat painfully thinking, with the paper still chaste and blank before me. My 9-year-old daughter asked what I was doing and I replied at her insistence and offer to help, "All right. I'm writing a paper to try to tell dentists how to run their business; how to handle the people who come to them. Sit down and write out what you think dentists should do for people." I continued to sit in unproductive thought while the child noisily scrawled. Presently she handed me the paper and I read: "Give them good care on their teeth and not to charge them too much and not to cheat them in any way."

I shall keep this paper to humble me because it proves the truth, if truth needs

proof, that children cut through to the heart of problems and see situations whole and see them clear while their elders are likely to bog down in the morass of details. I shall frankly use this child's philosophy as the basis for this discussion on the conduct of a family dental practice.

First, what do we understand by "give them good care on their teeth?" Who are the "them"? The "them" are the 123,000,000 persons in the United States, 33,500,000 of whom are children under 14 years of age. And of these children the White House Conferences on Child Health and Protection report 95 per cent, or over 30,000,000, suffering from dental caries. Five hundred child patients for every dentist in the United States! What could each of us do with 500 child patients? Yes, we can do as many of us in our short-sightedness now do: we can discourage dentistry for children; we can slop in cement here and there; we can pick out a dangling deciduous tooth now and again. We can sing the old bromides of apathy and indifference: "It's only a baby tooth; it shouldn't be pulled." "Nature will straighten out those crooked teeth." We may excuse this type of inaction; we may defend ourselves thus: "Children tire me with their squirming and questioning and crying." Or, "I can't get paid for children's dentistry."

It is true that dentistry for children may often be fatiguing to the operator, and sometimes not particularly profitable, but the fact remains that an attitude of smug indifference to preventive services is not strictly professional; but it is also plain poor business.

Practical contemporary political economists like Stalin and Mussolini know that the expression "the child of today is the man of tomorrow" is not idle rhetoric. Their diametrically opposed concepts of the perfect state are both built about plans for the proper training of youth. Likewise, to qualify for aptness, "the child patient of today is the desirable adult patient of tomorrow." I daresay that many depleted practices of today can be directly traced to an indifference or apathy toward the source of supply—the child.

We have still to interpret "give them good care on their teeth." In the case of the child, along with regular prophylaxis and operative dentistry, we have economic opportunity in preventive dentistry. For instance, in cases in which deciduous teeth are lost too early, we may and should construct space maintaining appliances, at a profit, to prevent malocclusion. This is preventive orthodontia. We may also make early operative intervention in the pit and fissure defects of permanent molars to prevent extensive caries with sequelae. This simple and valuable and profitable operation has the misfortune to be labeled with the pompous name "prophylactic odontotomy." Then, there are the economic opportunities in nutritional reinforcement programs for children. It is only fair that if we are to study and train ourselves to give intelligent nutritional advice, we be paid for it. As soon as we convince *ourselves* that the dental consultation on matters of child nutrition, as well as on all dental subjects, is valuable to the patient, we will have little difficulty in being paid fairly for it. Not to give our patients this kind of valuable advice is ethically unfair; not to be paid for it is economically absurd.

When we say that the construction of space maintainers, prophylactic odontotomy and the giving of advice on diet are opportunities frequently overlooked, we, of course, mean professional and economic opportunities to the dentist which consitute a valuable service to the patient. I have short patience with any one who

suggests dental economic activities that are intended for the pecuniary gain of the dentist alone. Whatever we do must be of value to the patient. High-pressure selling, misstatement of facts and unnecessary treatment are professionally contemptible and, in the long-term, economically disastrous. When we lose the reputation in the community of being an honest dentist, who gives honest opinions free from the flavor of high-power selling, we lose our principal professional and economic possession. In passing, let us reflect, where are the high-pressure salesmen of yesterday? For the most part, they are defunct and in eclipse.

In the treatment of both the child and the adult, too few of us use the x-ray machine enough. Many of us still consider the roentgen-ray examination as a laboratory test, to be used almost exclusively in the search for pathologic conditions of root-ends. Still too many of us use the roentgen rays for "suspicious teeth" only—whatever that means. For my part, I prefer to consider most teeth with a suspicion of incipient caries, or supporting tissue disturbance, or root-end disease, until they are proved to be normal. The most conclusive proof of normalcy or otherwise, as far as I know, is the roentgenographic examination. For the surprises that we often experience—proximal caries where we expected none, periodontal disturbance without clinical signs, root-end disease without symptoms—I am convinced that none of us does full justice to his patients without advising a complete roentgenographic examination in every case. Because the roentgen-ray study is painless and harmless to the patient, I prefer to err on the side of safety and thoroughness and recommend the roentgenographic examination to every patient. If the patient refuses, that is his misfortune. My conscience is clear.

Furthermore, I believe that the dentist serves his clientele best who makes periodic roentgenographic examinations of his regular patients. I make no apology in the suggestion to my patients that they have a complete roentgenographic study every two years at least. There is no other objective evidence that we may avail ourselves of to determine the change from susceptibility to immunity to caries or vice versa; there is no other laboratory test now available that tells us the story of the change in the metabolism of the alveolar bone.

The general practitioner should be the family friend. That does not mean that it is necessary to be the back-slapping, first-name calling hail-fellow. Friendliness is not synonymous with familiarity. He serves best who knows something of the family fortunes and misfortunes. And particularly the family dentist should know something of the family health problems. Not that we expect him to treat little Harry's "nervousness," for it may be chorea. Not that we expect him to prescribe for Cousin Hattie's loss of weight, for it may be tuberculosis. Not that he should recommend anything for Uncle Abner's "indigestion," for it may be a malignancy. But he, the general dental practitioner, can be a valuable family friend, a first-line guardian of health, if he thinks in terms of general medicine and has enough knowledge to recognize the forerunners of systemic disease and refers his patients to competent physicians and surgeons. I feel strongly on this matter, because dentists see people who usually do not come under the observation of physicians; people who are well, and those in incipient disease. To those who are well, he can talk the fundamentals of health; for those incipiently unwell, he can recommend competent medical care. Thus the dentist can be an important force in preventive medicine.

Finally, I should like to comment briefly on the subject of dental health education. Some men in the profession favor a widespread and costly campaign of education over the radio and through newspapers and magazines sponsored by dental organizations. As far as I can see, this plan has the dangers of being professionally degrading by placing us in the public eye in the category of merchants. For radio advertising to be effective, it must be entertaining. If good entertainment is given, the cost is high. And I can hardly contemplate, even if the money were forthcoming, the situation in which organized dentistry sponsored jazz bands, comedians or detective story thrillers. In the case of newspaper and magazine advertising, to give the public a bit of the spectacular is usually necessary, and I cannot imagine a professional organization going beyond and outside scientific facts to advertise our services to the public. For those who still insist that organized dentistry should cry its wares in the market place and fly in the face of long-established professional tradition, there is one devastating argument against *paid* publicity that is unanswerable. Effective popular advertising costs large sums of money, and if the costs of advertising, which would directly or indirectly be underwritten by the profession, were added to the costs of dental care, dentistry would be still farther out of the reach of the average family.

The general practitioner in dentistry still has at his command the most effective kind of educational method; that is, he has a personal, intimate and confidential relationship with his patient, the kind of relationship that any general advertiser would quickly trade for impersonal advertising by radio or the printed word. Any advertiser will be quick to agree that he would promptly exchange his medium of impersonal advertising for the attention and confidence afforded by personal contact with his prospective clients.

I would suggest, then, in this discussion of the maintenance of a family dental practice, that the dentist make strong and vigorous efforts to educate the people and families that he is *now* attending on the health significance of dentistry. If he takes the time and effort to teach his clientele, to show his patients what dentistry is and what it can do, he can be assured that he will maintain and enlarge his practice. If he gives adequate dental care and dental health education to the 20 per cent of the population who are now seeking attention, he may reasonably expect that this minority in time will spread the story of dentistry to some of the 80 per cent who are at present indifferent to or unable to pay for dental services.

708 Church Street.

A PRACTICAL DENTAL HEALTH PROGRAM

By THOMAS THERON SMITH, D.D.S., Canton, Ill.

A DEFINITE relationship exists between the number of cavities in the teeth and the student's progress in the classroom. This statement, its truth self-evident and corroborated with increasing frequency as one educational system after another completes surveys and studies of retardation, provides the basis for considerations too often glossed over or forgotten.

But some dentists and school officials pause to ask, "What are we to do about it?"

Those of us residing in Canton, Ill., a community of 12,000 persons and with a school population of 1,600 pupils in the first eight grades, believe that we have solved the problem. At least, the results have been such that the percentage of children free from dental defects has increased from 8 to 76.8 over a ten-year period. With the students liberated from distracting toothache, the cost of retardation was reduced during the first five years an average of $8,000 a year, a substantial portion of which has been credited to improved mouth hygiene conditions. There has been a decided increase in the percentage of students making normal progress, and but few are required to repeat grades.

Financial aid from taxpayers, in order to carry the burden of the dental program, has not been requested, for the plan in use in Canton was fostered, and is being maintained, by Canton dentists.

The procedure is simple. Pupils are grouped by the superintendent and assigned by lot to the dentists early in each school year. Principals make contact with the dentists immediately, arranging for a time when each dentist will appear at the school assigned to him. Assisted by the teachers and school nurse, the dentist examines the teeth of each child. On special cards designed by the dentists, and printed by the high school press, defects are indicated.

Parents and children are urged to have defects remedied at once. They are provided a duplicate of the card retained for the records, the teacher emphasizing the fact that the cards should be returned as soon as possible bearing the dentist's mark indicating that needed work has been done.

The object, of course, is to stimulate sufficient interest that all the cards will be returned. To "100 per cent" rooms, the board of education gives prizes, the state department of public health cooperating by issuing certificates.

Canton's first 100 per cent room did not achieve its honor until the third year of the annual surveys; but the record one year recently included a list of thirteen 100 per cent rooms. In that year, two entire buildings, one of five rooms, the other of four, attained a perfect rating.

A principal of one 100 per cent school describes her stimulation of interest campaign as follows:

> For several days before the dental inspection, we have short health talks by the pupils and the school nurse on the care of the teeth and correct foods for building good teeth. The school nurse also gives a toothbrush drill, showing pupils the correct way to brush the teeth.
>
> As soon as the inspection is completed, the teachers mount the cards which are marked O. K. and place them, alphabetically arranged, in a conspicuous place in the room, and in such manner that the spaces will identify the pupils who have not had their cards returned. Of course, the teacher uses every opportunity to explain to visitors (in the presence of the pupils) about these cards. This encourages the pupils to have the teeth taken care of before the dental inspection, if possible. They are happy to say, "I have had an O. K. on my card every year."
>
> After these cards are placed on the bulletin board or in some other conspicuous place, the real work for the teacher begins, and her interest must be kept at fever heat until the last card is returned with a dentist's O. K. Every day, she must ask what has been done and said in the home, that the child who is inclined to be dilatory may be spurred to action.
>
> There will always be someone who is anxious enough to have this card placed on the bulletin board to visit his dentist soon. This is the teacher's opportunity. Many interesting things happen to the pupil the day he appears with the dentist's O. K. As soon as he hands his card to the teacher, she makes the announcement that John has his card oked. Everyone is so delighted with this statement that it brings forth a round of applause and John feels proud of his accomplishment. A

short period of general rejoicing follows, and John is congratulated by everyone in the room, the other pupils marching past him and shaking hands.

Now a crepe paper cap (such as is worn at parties) is given John and, amid the applause of the pupils, he leads the parade of all who have perfect teeth through all the rooms of the building. Those who do not have perfect teeth are, alas, left sitting in their seats. For the rest of the day, John is given special little privileges, such as choosing the songs to be sung and the games to be played.

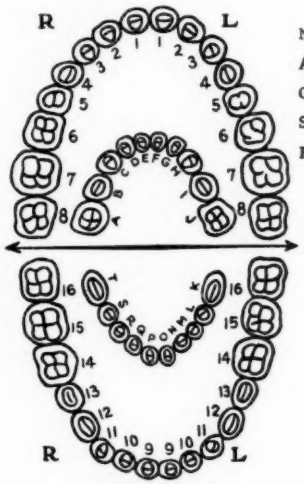
As time goes on and interest lags, the teachers add a new interest by promising to have a party as soon as all teeth are oked. The party may be as simple as can be, but the children think it a great event, and it helps to sustain interest.

Throughout the campaign to improve mouth hygiene conditions, to eliminate possible difficulties within the profession, the point is emphasized that the dentist employed to render the necessary dental service for the children should be their own family dentist and not the one who inspected the teeth, unless it so happens that their own dentist inspected their teeth at the school.

Most of the ten dentists participating in Canton's school dental program serve needy students in their group without charge, while not one has failed to make an inspection of the group assigned to him. This, together with the enthusiastic support of the superintendent, teachers and board of education, is responsible for Canton's high rank in mouth hygiene in the state for several years.

Through the efforts of the county lieutenant of the mouth hygiene and public instruction committee of the Illinois State Dental Society, assisted by every dentist in the county, schools throughout the county are being pledged to the definite Canton program. The supervisor of mouth hygiene of the state department of public health also has studied the program in considering a state-wide campaign to improve the conditions of children's teeth.

Whether the school is large of small, results are apparent in improved appearances, gains in weight and general health, deportment, increased attendance, and corresponding scholastic attainment.



Name .....
Age .....
Grade .....
School .....
Remarks:

Record chart.

"Healthmobile" in Maryland

Seven counties in southern Maryland and on the eastern shore were visited by the "Healthmobile" of the Bureau of Child Hygiene of the Maryland State Department of Health on its tour last summer. During the eleven weeks of the tour, eighty-five communities were visited and eighty-nine health conferences were held for the examination of infants and children under school age. Of 1,589 children examined, 1,137 needed followup care of some sort, about 216 were underweight and 142 had unhealthy tonsils. Of the total number, 1,341 children were given dental examinations and 767 were treated by the dentist.

Mothers and Babies First

An announcement has just been received from the American Child Health Association that again this year May Day will be celebrated as Child Health Day. Because of the long period of financial distress, there is continued need for special measures to protect the health of mothers and young children. Dentistry must play its part in supplying that need.

It is suggested that every state and component dental society cooperate with the official health and emergency relief agencies in preparing its state-wide child health programs. If you have not already done so, get in touch with your May Day chairman and plan a May Day-Child Health Day program for your community. The name of your state chairman can be secured from your state department of health.

May Day—Child Health Day

May 1 will be celebrated as the tenth anniversary of National Child Health Day. In the years since its initiation by the American Child Health Association in 1924, the observance of the day has undergone significant changes. Each year, it has struck a deeper note. Each year, new groups have realized that they had a contribution to make. Steadily from May Day to May Day, communities have come to understand that teamwork for child health is for the best interests of children.

Of all the values of May Day-Child Health Day, perhaps the greatest is the opportunity it presents to enlist the active interest of groups which might otherwise not give the subject of child health any particular thought, and to draw them into the general program.

The spirit of cooperation, be it purely local or statewide, has been fostered by the activities which have had May Day-Child Health Day as their inspiration. Communities working together for a single project have got a taste of real cooperation, and have discovered its value as well as its difficulties. They have found that working together was time-saving, money-saving and even sometimes life-saving.

At this time, more than ever, when appropriations and budgets are being almost universally cut, individuals and groups should strive to come together for child-saving programs connected with the desperate needs of the hour.

The State and Provincial Health Authorities of North America, the body which last year in conference assumed future responsibility for the national conduct of Child Health Day, believes that adequate care for babies and for expectant and nursing mothers must be the foundation on which to build a nation of healthy children. They have therefore elected to continue the use this year of the slogan, "Mothers and Babies First." The health officers are fighting to maintain the public health measures which they believe most necessary to protect infant and maternal health. They need popular support as never before. They will welcome the cooperative activities of groups of citizens drawn together in May Day-Child Health Day programs. In nearly every state, the state chairman for May Day is to be found in the state board of health, in the bureau of child hygiene, where such bureaus exist. Therefore, where it seems desirable, the opportunity exists for promulgating a statewide May Day program covering some particular aspect of child health.

More often communities decide on their own local projects, which may cover babyhood, the preschool age or the child at school, or all three. Wherever or whatever the project, National Child Health Day is becoming year by year more productive of practical results.

From the first year of its observance, May Day-Child Health Day has had for its symbol the daisy. There is something in the milk white beauty of its petals which recalls the innocence of childhood. But those who know this flower will recognize also its vitality. Drought cannot kill the daisy; storms pass over it in vain. We want this vitality for our children; we want so to build that, as Calvin Coolidge once said, "America may produce men and women worthy of our standards of citizenship." This can only be done by joint action. No home, no school, no public or private agency can take on the whole task. Teamwork and understanding among all are needed to reach the goal of May Day—children whole and healthy in body, mind and spirit.

THE BUREAU OF PUBLIC RELATIONS ANNOUNCES A SERIES OF OFFICIALLY APPROVED ARTICLES FOR NEWSPAPER RELEASE

In accordance with a plan proposed by the Educational Publicity Committee and approved by the Board of Trustees of the American Dental Association, the Bureau of Public Relations is preparing a series of fifty-two newspaper releases.

This series is written in the form of a semicontinued story. Each installment contains one or more dental health lessons. Written in an interesting, conversational style, they will be readily accepted by newspaper editors for weekly insertion in their columns.

Each article has the official approval of the American Dental Association and the United States Public Health service. This endorsement will appear at the head of each installment, plus the endorsement of the local dental society or local health officers, in case that is desired.

The first sixteen of these articles are now ready for release. They will be distributed free to state and component societies on request. The first installment of the "John, Mary and Jack" series is printed below. Other incidents in little Jack's life follow in chronologic order.

DENTISTRY AND PUBLIC HEALTH
Approved by
The American Dental Association and the United States Public Health Service
and
The Local Dental Society

JOHN, MARY AND JACK

CHAPTER I

"Home again, honey, and starved. How about something to eat?" cried John, as he banged the front door shut behind him.

"All ready, dear," answered Mary, as she returned his kiss. "Run along and wash. Everything will be on the table in two seconds. Goodness! I wonder if all men are as hungry as you are every night."

The evening meal proceeded in relative silence as the hungry young husband devoured his wife's savory food. At its conclusion, John pushed back from the table. Appetite satisfied, a freshly lighted pipe, a comfortable chair —a feeling of peace and quietude descended upon him.

Mary sat watching him for a few minutes scarcely knowing how to start. Finally, fortified by a sip of coffee, she began. "John, dear, I've something to tell you." She hesitated, swallowed and finally stopped.

John emerged from the haze of tobacco smoke. "What's on your mind, Mary?"

"Well, I, that is we," again Mary stopped.

"Humph," said John, "I know. Don't tell me. More relatives coming to visit us; isn't that right?"

Mary looked at him for a second and her eyes grew wide and serious. "Yes, John," she said softly, "I think we are going to have a visitor—a relative—a very near and dear relative and he is going to be with us for a very long time, I hope."

It took John several seconds to catch her meaning, but finally the truth dawned upon him. "Gee!" he cried, "that's swell. Will wonders never cease!" He took Mary in his arms and kissed her. Needless to say the rest of the evening was spent in serious speculation.

Long after midnight John said, "Neither of us know much about this sort of thing, Mary; we must get some advice." "I might," said Mary, "speak to Mrs. Murray. She has had six children." "Yes, said John, "and I could ask the boss, who has had four." And one by one they listed their older friends with families.

Finally Mary said, "John, we're so dumb. Just a couple of babes in the wood. Why ask your boss? Why ask Mrs. Murray? If we are going to have a visitor, we need advice—good advice—so let's get the best possible. We will find a good physician—one who knows babies—and put our case in his hands."

"Right, as usual," said John, as he turned over to go to sleep.

The next day Mary Reynolds visited the physician and asked his opinion. "I wish," said the physician after he had confirmed her suspicions, "that more young couples used your judgment. Child bearing is a normal procedure. If nothing unforeseen happens, you have little to worry about. But you must take good care of yourself. Your own health is most important, because until your baby is born his physical condition depends upon your own."

He then gave Mrs. Reynolds a thorough physical examination including the necessary laboratory tests. Fortunately, this examination indicated that Mary was normal and healthy.

She and the physician were both pleased. At the conclusion of the examination, the physician said, "Young lady, you have a long and serious job ahead of you. It requires some degree of intelligence to perform it satisfactorily. I'm willing to help you, but I can't do it all. You must help yourself.

"Here is a diet list. Take it home and study it and use it every day. It is very simple, but very necessary. Next I want you to get out doors as much as possible. Take plenty of mild, not vigorous, exercise, and I want to give you an examination including blood pressure and urinalysis at least once a month until further notice.

"Lastly, see your dentist at once. It is absolutely necessary that your body be free of infection. Dental infection may injure both you and your child. Have your dentist get in touch with me so that together we can give you the best possible care."

Mary called her dentist from the physician's office. Fortunately, he could give her an immediate appointment. She told him at once of her condition and asked his assistance and advice. First he x-rayed her teeth, just to be sure there were no abscesses, pyorrhea pockets or other hidden infection present. Had there been he would have removed or corrected the condition so that it could not poison her system.

His examination revealed four small cavities and he gave her an appointment to have them filled. He instructed her regarding the proper home care of her mouth and gave her a printed list of foods to include in her diet so that she could build good teeth for her child and keep her own teeth healthy. He assured her that by following the advice of her physician and himself she need not fear that old worn out bugaboo "for every child a tooth."

Mary, thanking him for his advice, informed him that Dr. Hayes had also given her a diet list.

"Of course," answered Dr. Young, "Dr. Hayes always watches his patients' diet very carefully in cases of this kind. You will find that the two lists coincide completely. The list I gave you merely emphasizes the foods that are necessary for good teeth."

Fraternity Sponsors Clinics

Figures that have just been released by the North End Clinic reveal the outstanding service that has been rendered for the past ten months by a group of Detroit dentists under the sponsorship of the Alpha Omega Fraternity.

During this period, the staff of thirty-five dentists has extended temporary relief and diagnostic service to approximately 5,000 patients. Of this number, 3,984, or 80 per cent, were given free treatment, while 20 per cent paid a small fee. These dental services were only given to persons who had been investigated by social service workers and found unable to afford regular private treatment.

The accompanying tabulation is an exact record of the clinic's dental department from March 1, 1933, through December, 1933.

1933	Visits	Free	Paid
March	480	383	97
April	629	496	133
May	471	373	98
June	512	407	105
July	496	404	92
August	586	483	103
September	412	329	83
October	512	395	117
November	493	405	88
December	396	309	87
	4,987	3,984	1,003

Besides the emergency relief work given to adult patients, the clinic also offers a regular dental service for children including orthodontic treatment as well as restorative work.

A permanent staff of dentists is maintained who give gratuitously several hours service a week at the clinic while others do emergency work at their offices. The services of this staff are directed by a board of governors composed of six members, one of whom supervises each day's operations at the clinic.

Visual Education as an Aid in Children's Dentistry

A Children's Party

A dental practitioner is confronted with the problem of developing in his juvenile patients the idea that a dental office can be a place of interest rather than the traditional "torture chamber." One way to accomplish this is to hold an occasional children's party in the reception room. The ease and inexpensiveness with which such a party can be given is surprising.

Recently, invitations were sent by an enterprising dentist to forty-nine children below high school age whose names had been in his appointment book during the last year. Forty attended the party, ten of whom were accompanied by their mothers.

No attempt was made to have games since the reception room was small. The party was built around educational dental motion pictures.

As the children arrived, the assistant greeted them and helped them to find seats on the floor in front of the screen. The mothers were seated on folding chairs in the rear of the room.

The show started with a four-minute film called "The Gingerbread Man and the Witch's Cat." This was followed by a sixteen-minute film called "Tommy Tucker's Tooth." This film shows two boys, one healthy, clean and attractive; the other sickly, careless and unattractive. Both boys apply for a position. The sickly boy is turned down, but is advised as to how he can improve his health and appearance.

This advice is illustrated with films showing correct brushing of the teeth and proper habits of eating and exercise and care in dress. A few visits to his dentist and his teeth are greatly improved. Later, he is accepted for a position by the man who gave him the advice.

A second film on dentistry was shown called "Ask Your Dentist." This the older children enjoyed. A Mickey Mouse film closed the show amid much applause.

Ice cream in cups with wooden spoons and cookies were served.

"Tommy Tucker's Tooth" and "Ask Your Dentist" were obtained from the American Dental Association at a rental of $1 per film. "Mickey Mouse" was rented from the Eastman Kodak Libraries at the same cost. Each of these films required sixteen minutes for showing.

Later, several mothers called and asked for information concerning the party, explaining that her boy or girl was showing unusual interest in mouth hygiene.

A children's party gives convincing evidence that visual education has its place in the dental office and that a visit to the dentist can be made a pleasure to the juvenile patients.

NEWS

MICHIGAN

Results of Membership Campaign: W. R. Davis, secretary of the Michigan State Dental Society, reports that he has received more requests from district secretaries and membership committees for applications during recent weeks than ever before, a number of districts evidently putting forth an extra effort to enlist the profession in organized dentistry. On February 21, at the time of their midwinter meeting, Flint reported thirty-five members as against twelve last year, the greatest number before in any one year being twenty-two. Bay City, which last year had eight members, this year has thirty, every eligible dentist being a member. Saginaw last year had twelve members and this year has thirty-seven, a 100 per cent membership. Midland has a 100 per cent showing with seven members. Similar results are rapidly being consummated in the smaller towns in the district. A membership committee has been appointed for three years and agrees to follow through.

Dr. Kelley Appointed Examiner: Boyd Kelley of Norway has been appointed to the state board of dental examiners.

NEW YORK

New York University Offers Postgraduate Course in Periodontia: New York University offers postgraduate courses in the etiology, pathology, diagnosis and prognosis of periodontal disease; equilibration of occlusion; gingival massage; instrumentation, stressing conservative treatment; Vincent's infection; drugs used; maintenance of mouth health; prevention; etc.; taught by lectures and practical work at the chair, each student handling his own cases with instruction given by the regular periodontia faculty. The courses cover half days for four weeks, to be arranged, beginning June 4. Enrollment is limited to fifteen.

Dental Alumni Annual Dinner: The New York University Dental School Alumni annual dinner will be held April 13. It is to be made the occasion of a demonstration of appreciation of the efforts of the state board of regents and education department to pass regulations tending to elevate the dental profession.

NORTH CAROLINA

Raleigh Society Contributes One Hundred Per Cent to Relief Fund: The Raleigh Dental Society has again contributed 100 per cent to the Dental Relief Fund, this being its fourth consecutive year to do so.

State Oral Hygiene Activities: In twenty-four cities and counties, the dental clinics are now being conducted by state school dentists under the supervision of E. Branch. In all cities and counties of the state, the state dental society, February 20 and 22, made a state dental survey, the purpose of both activities being to arouse new interest in the importance of healthy teeth and gums.

DISTRICT OF COLUMBIA

Dental Society Host to State Societies: The District of Columbia Dental Society will be host to the members of the state societies of Delaware, Maryland, North Carolina, West Virginia and Virginia. Three days of instruction on caries, children's dentistry, pyorrhea alveolaris, prosthetics and other phases of modern dentistry will be conducted by the men from both Canada and the United States.

NEW JERSEY

Bills Passed: S. 183, a bill to supplement the Medical Practice Act, proposes to make it a misdemeanor for anyone other than a person licensed to practice medicine and surgery to "use in connection with his name the words or letters 'doctor,' 'Dr.' 'physician,' 'surgeon,' 'M.C.,' 'M.B.,' 'specialist,' 'professor.'" A. 245, a bill to amend the dental practice act, proposes, among other things, to add to the grounds on which a license to practice dentistry may be revoked if violation of any of the rules or regulations which the state board of registration and examination in dentistry may hereafter adopt with respect to the practice of dentistry.

FOREIGN

A New Journal: A new journal, "Deutsche Kieferchirurgie," has appeared, published by George Thieme, of Leipsic. It is designed to serve the Society of Oral Surgery. The first issue contains seventy-eight pages and is well illustrated. The contributors to the first issue are Prof. G. Axhausen (editor) of Berlin; Charles Bruhn, Dusseldorf; A. Lindeman, Dusseldorf; Hans Pilcher, Vienna, and W. Rosenthal, Leipsic.

Entrance Requirements, Emphasizing Standards of Acceptance from Both Foreign Universities and Foreign Dental Schools: Nether-

lands: There is but one dental school in connection with the University of Utrecht. Graduation from a Dutch high school is required for admission. As previously stated, the high school course in this country is one of five years and is unquestionably more advanced than our high school courses, although it is preceded by but five years of primary education. It is about equivalent in value to the additional American predental year except that it is not so advanced in the sciences. The Dutch gymnasium has the same standing and standards as the high school, but its course contains more of the "humanities" and is the preferred preparation for law rather than for medicine or dentistry.

Denmark: There is but one dental school in Denmark, a private dental institute affiliated to the University of Copenhagen. High schools in Denmark are highly developed, but they do not admit to the University in its various departments though they admit to the dental institute. The primary school (Folkeskoler) covers a period of five years. Students then enter the secondary school (Mellemskoler, or middle school), which covers four years. They then enter the gymnasium and at the end of one year may take the examination called "Realeksmen," which admits to the dental institute a certain number of students. Two years more of study in the gymnasium prepares the student for the "Studentereksamen," which admits to the University of Copenhagen. The dental institute also takes a number of students who have passed this examination, but some are admitted in the lower standard above given, which about equals three or four years of an American high school. The "Studentereksamen" is generally recognized as the equivalent of the first and second years of a good liberal arts college in the United States.

Norway and Sweden: In each, one dental school only exists, the preliminary education being the "artium" or "maturum" certificate, which means a good secondary school course. The dental schools are affiliated with the King Frederich University in Oslo, Norway, and the Royal Caroline Medico-Chirurgical Institute in Stockholm respectively.

Finland: There is a dental school of the University of Helsingfors requiring a gymnasium course ("artium") and a preliminary medical examination (requiring about two and one-half years) for entrance, with three and one-half years of dentistry for the certificate of dental proficiency (odontologic licentiat).

Latvia: The University in Riga has a dental course of five years, two of which are in medical sciences, two in clinical dentistry and one practical year with examination. It is believed that a gymnasium course is required for admission, but on this point accurate information is lacking.

Deaths

Booth, R. G., Madrid, Iowa; Chicago College of Dental Surgery, Dental Department of Loyola University, 1899; died, January 12; aged 57.

Burkett, Clifford W., Plymouth, Ind.; Northwestern University Dental school, 1910; died, January 1.

Byers, C. L., Indianapolis, Ind.; Indiana University School of Dentistry, 1904; died February 23. Dr. Byers was the secretary of the state dental association.

Freeman, Arthur B., San Diego, Calif.; Rush Medical College, 1885; died, January 26; aged 75.

Hall, John S., Detroit, Mich.; Detroit College of Medicine, Department of Dental Surgery, 1897; died recently.

Hunt, Alfred O., Omaha, Neb.; State University of Iowa, College of Dentistry, 1883; died, January 12.

Kellogg, H. H., Sioux City, Iowa; Northwestern University Dental School, 1896; died, January 25.

Locheed, J. A., Hamilton, Ontario; Sovereign Great Priory of the Dominion, Regina; died recently; aged 76.

McCartney, Ernest F., Sioux City, Iowa; Northwestern University Dental School, 1899; died, January 20.

MacDonald, G. B. R., Washington, D. C.; George Washington University Dental School, 1907; died, January 9; aged 54.

McWilliams, H. A., Farmington, Iowa; State of Iowa, College of Dentistry, 1909; died, January 16; aged 46.

Meyer, Paul E., Sacramento, Calif.; University of Michigan, College of Dental Surgery, 1914; died, January 1.

Sexsmith, H. S., Glencoe, Ill.; Northwestern University Dental School, 1901; died, January 18; aged 55.

Weisz, Alexander G., Winnetka, Ill.; Chicago College of Dental Surgery; died, February 26.

Welch, J. G., Dallas, Texas; State University of Iowa, College of Dentistry, 1915; died, January 20.

Timerman, L. A., Fort Plain, N. Y.; Temple University School of Dentistry, 1897; died, February 24.

MISCELLANY

BOOK REVIEWS

Practical Anesthesia for Dental and Oral Surgery, Local and General. By Harry M. Seldin, D.D.S., Director of the Division of Dentistry, Department of Hospitals, City of New York: Honorary President of the Eastern Society of Dental Anesthetists; Member of the American Society of Oral Surgeons and Exodontists; Formerly Chief of the Department of General Anesthesia, New York University, College of Dentistry. Cloth. Price, $7. 508 pages, with 203 engravings and a bibliography. Philadelphia: Lea & Febiger, 1934.

Most treatises on anesthesia in dentistry deal with local anesthesia; a few with general anesthesia: this volume discusses local and general anesthesia. In the preface of the book is the following:

"More than a decade of contact with the educational requirements of dental students and practitioners has made clear to the author the great need for a comprehensive, accurate and, above all, practical text-book on dental anesthesia, both local and general. . . . Local and general anesthesia are equally important from a practical standpoint and are intimately interrelated. They should not be set one against the other, for each has its place. The truly skilled anesthetist is he whose training enables him to analyze the situation confronting him and to decide upon the anesthetic agent best suited to the particular case in hand."

Under "Local Anesthesia," the following chapter headings indicate the range of the topics discussed: "Local Anesthesia; Its Significance," "Anatomical Basis for Local Anesthesia," "Anesthetic Solutions," "Instrumentarium," "Preparations for Anesthetization," "Field Block or Infiltration Anesthesia of the Maxillae and the Mandible," "Intraoral Block Anesthesia of the Mandible," "Intraoral Block Anesthesia of the Maxillae," "Extraoral Block Anesthesia of the Maxillae and Mandible," "Practical Application of Local Anesthesia (Including the Handling of Difficult and Unusual Cases)" and "Complications of Local Anesthesia and Their Treatment."

The following chapter headings under "General Anesthesia" indicate the field covered: "The Selection of Anesthetics for Oral Operations," "Physical and Chemical Properties of Nitrous Oxide and Oxygen," "Practical Physical Diagnosis for the Dental Anesthetist," "The Physiology of Inhalation Anesthesia," "Control of Respiration—Rebreathing and Carbon Dioxide," "The Effect of Nitrous Oxide upon the Human Body," "Premedication and Preanesthetic Suggestion," "Armamentarium," "The Administration of Nitrous Oxide and Its Mixtures," "Analgesia," "The Management of the Recalcitrant Patient," "Ethylene," "Ethyl Chloride," "Somnoform" and "Resuscitation."

The author has achieved a large measure of success in making the book understandable and usable, both for teaching and for practical purposes. One feature that deserves particular mention is the drawings of the parts concerned in local anesthesia. These are separately and interrelatedly discussed under osteology, neurology, myology and the circulatory system.

Contrary to the excellent presentation of the anatomic and operative aspects of the subject discussed is the attempt to deal with various prepared solutions of procaine hydrochloride and other local anesthetics and other materials of the drug armamentarium used in surgery. This is the most disappointing part of the book. The fault lies not so much with the author, but rather with the incomplete information on many of these products available to the dentist.

While the author quotes extensively from the work of Koch, Goldberg and Gralnick,[1] he makes no mention of the earlier and more fundamental work of Gros[2] and of Sollman on

1. Koch, E. F.; Goldberg, S. D., and Gralnick, A.: Preliminary Report on an Investigation of Postoperative Sequelae and Toxicity of Anesthetic Solutions, November, 1930.

2. Gros, O.: Ueber Narkotika and Lokal Anaesthetika, Arch. f. Exper. Path. u. Pharmakol., 67:132, 1912. Ueber eine Methode, die anaesthesierende Wirkung der Lokal Anaesthetika zu Steigern, München. med. Wchnsshr., 1910, p. 2042. Laewen, A.: Ueber die Verwendieng des Novokains in Natrium bicarbonate —Kochsalzlosunger zur lokalen Anaesthesia, Münch. med. Wchnsshr., 1910, p. 2044.

alkaline local anesthetic solutions. The work of Koch and co-workers contains so many objectionable elements from the point of science and practice that its quotation *in extenso* detracts from the excellent character of the book. Years ago, Gros discussed certain chemical and pharmacologic aspects of alkaline solutions of procaine for local anesthesia, and a more recent discussion is that of Sollmann.[3] These authors pointed out the underlying factors as well as the limited usefulness of alkaline solutions, although Gros years ago suggested the advisability of using freshly prepared local anesthetic solutions in an alkaline medium.

There is no question that the employment of highly acid solutions may lead to postoperative disturbances, but the difference between an alkaline and an acid solution, within reasonable limits, has not yet been the subject of carefully controlled study.

The references to the work of Freeman and co-workers at Northwestern University Dental School, on the other hand, add strength to the discussion, since the results of these workers were reported conservatively and with the admonition that future experience is needed before final statements are made. Whereas, Freeman and co-workers discussed the advantages of freshly prepared alkaline local anesthetic solutions, the compositions of the so-called buffered solutions referred to by Koch and co-workers are not given to the readers; an important point since not a new drug, but a new vehicle for an old and useful drug, is under discussion. Epinephrine has the same reaction, provided it is levorotatory, and there is no convincing evidence of difference between the natural and the synthetic product as the author attempts to show.

The tabulation in this chapter of a "Chart of Equivalents—Anesthetic Solutions" is interesting, but what definite educational purpose it serves it is difficult to tell. Why the author compared only the Metz, the novocol and the Waite solutions in ampules, cartridges and other containers is not easy to see, unless these are assumed to be the brands most widely used. During the time the book was being written, other prepared local anesthetic solutions were on the market, differing in no essential in their content of procaine and epinephrine. The difference rested only in a trade name applied to the container, such as unitubes, procosol tubes, extractotubes and klic-off ampules. But here the system that tends toward secrecy, and not the author, is at fault, since the author has in some respects performed a service in attempting to bring equivalents together. It is unfortunate that so much emphasis is given the type of syringe as against the really important agent, the drug. The tabulation of the author serves to point out the difficulty of speaking definitely of the not completely known.

The formula given for the vehicle in Waite's solution is not the same as that being marketed today. It was used years ago and sold as the "Antiseptic local anesthetic." Nevertheless, the author is correct in pointing out the inadvisability of using a local anesthetic in a vehicle containing phenol, glycerin, iodine, thyme, eucalyptus, mentha-arvensis baptisia, gaultheria and benzo-boracic acid, for the sooner such combinations are discarded, the better for dentistry.

Although it appears that the author is opposed to secret preparations, much space is wasted with descriptions of proprietary products. It is discouraging to see a modern book refer to such drugs as allonal and peralga, two proprietaries which were found not acceptable by the Council on Pharmacy and Chemistry some years ago. Since then no evidence has come to hand that the combination of a hypnotic and an analgesic in fixed proportions are desirable for general preoperative and postoperative medication. Each drug has its own effects, and they should be prescribed according to individual needs.

Several pages are devoted to the subject of surface anesthesia, preparatory to inserting the needle, since the author believes that it is desirable to desensitize the gum before making the puncture. Many excellent operators are not in agreement as to the usefulness of this type of anesthesia, since they hold that careful technic and a sharp needle does away with the necessity for preanesthesia. To bring about topical anesthesia prior to injection of the needle, several simple and compound drugs are suggested. Some of them have stood the test of time, others have not. The drug "novesthene" is included in the list. Why this unacceptable designation for ordinary ethyl aminobenzoate (benzocain, anesthesin) should

3. Sollmann, Torald: Comparative Activity of Local Anesthetics, J. Pharm. & Exper. Therap., 10:379, 1917; Comparative Efficiency of Local Anesthetics, J.A.M.A., 70:216 (Jan. 26) 1918; Comparative Activity of Local Anesthetics, J. Pharm. & Exper. Therap., 11: 1, 1918; ibid., p. 9, 17 and 69; Comparative Absorbability of Local Anesthetics from Urethra, ibid., 11:159, 1918.

be included in a modern textbook is not known, for the multiplication of names for common drugs is not conducive to the dentist's interests. It would have been much better if the author had included exclusively nonproprietary formulas for these agents, many of which are available.

Under "General Anesthesia," the information on the physiology of inhalation anesthesia is useful and should find a ready response on the part of the reader, as should the chapter on "Determination of Good Anesthetic Risks." The author inclines toward the use of nitrous oxide and oxygen, and thus his leanings are in line with experience.

It is regrettable that the author of a modern textbook should advise the use of cactin for premedication and validol for postmedication. Modern textbooks on pharmacology do not devote much space to cactin or to the ester of butyric acid sold as validol. At one time, cactin preparations were used because of their supposed digitalis-like effect on the heart, but careful observations have failed to find any clinical effects. The advantages of scopolamine-morphine premedication are not apparent, and the mixture is made irrational by the addition of cactin. Bevan[4] concluded that the use of scopolamine-morphine adds to the risks of ether, gas or local anesthesia, more than morphine alone.

Validol is a hangover from the days of earlier therapeutics. No reliable pharmacologic or clinical evidence for its usefulness as a stimulant, aside from the psychologic effects due to its ill odor, exists.

The author dismisses ethylene as useless in dental practice, largely because of its claimed inflammability. That it has advantages is not denied by the author. The experience of the Presbyterian Hospital in Chicago on 20,000 cases up to 1931 without a death is indicative of the safety of ethylene-oxygen anesthesia. It is true that a mixture with air in certain proportions is explosive, but this institution, as well as other institutions, have overcome this by taking precautions to do away with static electricity.[4]

The foregoing critique should not be interpreted to mean that the book has not its useful points along the lines under discussion. The advice of the author in respect to anesthesia by intravenous injection of barbiturates, of avertin and of somnoform is in keeping with modern and progressive thought on the subject. The evaluation of somnoform is particularly to be commended, for the writer says that "The art of anesthesia cannot be learned from manufacturer's pamphlets but from the teachings of trained anesthetists. . . . " The final chapter on "Resuscitation" is well put.

The book has so many good points that it is hoped when a subsequent edition is written, the author will be in a position to evaluate more critically, for the benefit of his readers, the points discussed above.

SAMUEL M. GORDON.

The New Aim in the Care of Teeth. By Howard R. Raper. Published by Haldeman-Julius Publications, Girard, Kan.

This is one of the Little Blue Book Series, number 1728. It is written in the characteristic style of the author, which means that it is written so that it may be understood. Not only that, but it is written in a distinctive style that no one uses except Howard Raper, for the simple reason that no one else is able to write as he does. From the day that Howard Raper began to write, which is eons and eons ago, more or less, there has never been any danger that his style would be mistaken for that of others. And few ever fail to read what he writes.

For this reason, there is no question about the amount of good that will come from this little book. Often, the statement is made that some certain book should be read "from cover to cover." Characteristically enough, this book begins with a crisp, significant statement, and ends with another. The preface says: "The purpose of this little book is to make an intricate subject simple enough to be interesting, to assist in placing the care of the teeth on a more effective, scientific and practical basis." The last sentence in the book is as follows: "It is a wise man who knows what to be afraid of, and I advise you to be afraid of cavities in your teeth—at least enough afraid of them to have them filled."

Between these two remarks, there are others of the Howard Raper type, embodied mostly in the author's well known plea for an interproximal roentgenographic examination of teeth to detect caries in its incipiency. A pointed paragraph is aimed in the direction of any stray philanthropist who may find it in his heart to devote a sufficient sum to aid in the prevention of dental disease, and the entire profession will join the author in the fervent hope that the philanthropist may ultimately be found.

4. Bevan, A. D.: Present Status of Anesthesia Problem, J.A.M.A., 97:1530-1536 (Nov. 21) 1931.

CORRESPONDENCE

Viosterol and Dental Caries (A Correction)

To the Editor:

In a recent issue of the Journal, Lennox,[1] in an article on dental caries, refers to a paper by Klein and Shelling (to be published in the *Journal of Dental Research)* from which he has drawn the following conclusions: "Rats fed diets low in phosphorus but high in calcium plus large doses of irradiated ergosterol (vitamin D) develop caries of the molar teeth. Rats fed diets adequate in calcium and phosphorus plus vitamin D develop caries of the molar teeth. Rats fed diets adequate in calcium and phosphorus without vitamin D do not develop caries of the molar teeth." From these conclusions, it might be inferred that the addition of viosterol to an otherwise adequate diet leads to dental decay, and that its omission from the diet is conducive to healthy dentition. Our recently published results[2] show definitely that vitamin D had little if any effect on the incidence of dental caries in our rats, and hence the implication that viosterol is a causative agent in the production of dental caries is contrary to our published conclusions. In fact, I do not know of any such contemplated publication, as referred to by Dr. Lennox, in which I am a coauthor. From the title of the contemplated paper, it appears that Dr. Lennox refers to experiments on the relation of the calcium and phosphorus of the diet to the toxicity of viosterol, conducted by Miss Asher and me and published in 1932.[3] The heads of these animals were examined by Henry Klein and by us for the presence or absence of dental caries, the results of which are embodied in the paper referred to above.[2]

The conclusions are: 1. Caries is infrequent in rats below the age of 100 days, irrespective of the diet. 2. The incidence of caries is high in rats on diets containing a large percentage of coarsely ground corn, and absent in rats on diets composed of casein and starch, or of grains the particles of which are finer and softer than corn. 3. In the rat, there is no correlation between the calcium and phosphorus intakes, the concentrations of calcium and inorganic phosphorus of the serum and caries-immunity and caries-susceptibility. 4. Since the caries-like lesions in the rat were probably due to physical injury by corn particles in the diet, the efficacy of vitamin D in preventing tooth decay cannot be evaluated from such experiments. 5. Results on the experimental production by this means of caries-like lesions in rats are not necessarily applicable to the etiology of dental caries in human beings.

From conclusion 4, it is evident that our results do not indicate a beneficial or detrimental effect of viosterol on the development of dental caries in our rats, since the caries-like lesions in our animals were probably due to the physical injury by the coarse particles of the diets, regardless of the presence or absence of viosterol.

Apparently, Dr. Lennox has been misinformed as to the results of our experiments, and I take this opportunity to correct any erroneous impression in regard to the relation of viosterol to dental caries which might be gained from reading Dr. Lennox's reference to our experiments.

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Department of Pediatrics,
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Baltimore, Md.

1. Lennox, Joseph: Observations on Diet in Its Relation to Dental Disease, J.A.D.A., 20: 2209 (Dec.) 1933.

2. Shelling, D. H., and Asher, Dorothy E.: J. D. Res., 13:363 (Oct.) 1933.

3. Shelling, D. H., and Asher, Dorothy E.: Bull. Johns Hopkins Hosp., 50:318 (May) 1932.

TRILOGY

Interest

An unusual sight at the clinic was a lone man climbing the stairs from the commercial display rooms to the floor above. Called to, he turned with a start. "I have been here two days," he said, "and you are the first man I have seen that I know." His smile attested relief and pleasure.

"Where are the boys from the Tri-County group?"

"Couldn't come. Collections bad," he said. "Took all my loose change," he grimaced wistfully.

"How are you enjoying it?"

"Great," he answered. "It's the best ever. I wouldn't have missed it for anything."

The town and three counties he represented will, it may be predicted, have an inspiration center for some time to come.

Idealism

An old man with attractively tousled, silvery hair sat in the lounge, talking to some cronies. His trembling, transparent, eloquent hands moved in unison with his cadences.

"A lot of my old patients come in from time to time to assure me that they have not forgotten me," he was saying. "They have need of work, but can't pay for it."

He looked from face to face for assurance, understanding, sympathy.

"What should I do?" he asked. "They and their families helped make me. They have paid me thousands of dollars. They are dear to me. What should I do?"

Nobody answered; nobody dreamed perhaps of what he would do.

"I mortgaged my home," he continued "so that I could take care of them, and then urged them to let me."

Looking at those nervous white hands that had given almost a half century of service, one wondered if they could ever lift that mortgage.

With that doubt in mind, a lump rose to one's throat. Judged by the hard standards of the day, here was a great humanitarian, an idealist who deserved a shrine.

INTEGRITY

A group of young men were discussing the theme of the past four years. The talk was a pot-pourri of worry and debt, their debts to others, others' debts to them.

None seemed to have much hope that any change was near. Finally one remarked:

"I suppose we could all go into bankruptcy and clean the slate."

Two laughed with the easy agreement of the typical conformist, but one flared, and his adjectives were not pretty.

"Bankruptcy," he snorted, "not for me. Why not suicide? Doors with 'Exit' painted yellow. I expect the folks who owe me to come across when they can, and I'll come across with my last nickel when I can. No bankruptcy for mine."

There was no reply, but the impression remained that there was still salt in the earth that had not lost its savor.

T.

CURRENT LITERATURE

Focal Infection of Tonsillar and Dental Origin (H. Bjorn-Hansen, Norsk mag. f. laegevidensk.; abstr. Am. J. Dis. Child., December, 1933): The authors consider a leukocyte count and a sedimentation test to be of help in the diagnosis of focal infection. These tests may give negative results in spite of the existence of an infection, but the results are positive in the majority of cases. Study of the patients whose cases are reported in this article has shown that focal treatment, that is, removal of tonsillar and dental foci, seems to prevent in many cases the development of secondary polyarthritis. Focal treatment in the acute stage is not advisable, as aggravation of the disease may result. Patients with focal infection are often hypersensitive to autogenetic vaccine.

First School Nutrition Clinic in Uruguay. (Nylia Molinari Calleros, Am. J. Dis. Child., December 1933): After compiling all the facts and taking into consideration the results obtained, the clinic is enabled to lay down the following conclusions: 1. Fundamentally, the nutrition clinics represent real schools of active hygiene, with prophylactic and economic benefits, both individual and social, which will be intensified and organized on a more scientific basis when the district clinics and the nutrition institutes are established. 2. Within the boundaries of the school activities, the chief benefit of the nutrition clinic is represented by the health and weight-height gain of the children who attend it. 3. The nutrition clinic spreads among the people the hygienic idea of what rational nourishment is in the balance of the nutritive and economic values, and teaches what is to be eaten, how much should be eaten and how it should be eaten. 4. It prepares the school population for a healthy life in future homes, imparting the knowledge of the advantages and need for a hygienic dwelling and personal cleanliness and of the sanitary influence of dress and shoes, and it awakens the parents to a sense of their responsibility as to heredity and environment, encouraging them to take better care of their children. 5. A decrease in weight, the exact origin of which is not clear, is felt by the children as a consequence of the intensification of their school activities.

Thyroid Tolerance of Well Children (Karl

Rupilius, Arch. f. Kinderh.; abstr. Am. J. Dis. Child., December, 1933): In the past, the child's temporary teeth have not received the care and attention that they should have. They play a definite rôle not only in proper mastication of food, but also in the development of the bony structure of the jaws, in the adequate growth of the dental arch in size and shape and in the stimulation of the tooth buds of the permanent teeth. Neglect of the temporary teeth, leading to their premature extrusion, causes malformation of the jaws and poor alinement of the permanent teeth with crowding and subsequent inadequate function. It is the duty of physicians and dentists to impress on parents the far-reaching influence of the temporary teeth and to aid in their preservation by timely prophylaxis.

Comparison of the Mineral Growth in the Human Fetus and the Infant (W. W. Swanson and L. V. Iob, Am. J. Dis. Child., December, 1933): The data in this study are divided into two parts: (1) the mineral growth of the fetus, and (2) the mineral growth of the infant. Complete analyses for nitrogen, potassium, sodium, chlorine, calcium and phosphorus were made on the ashes of sixteen fetuses of different ages. A study of three full term normal infants with respect to the retention of minerals and the probable composition of the minerals had been made previously. The findings on two of these infants have been published. Graphs constructed from these data, based on composition at birth and retentions for added weight, are compared with graphs based on fetal data. It is interesting to note that in postnatal growth, the composition per kilogram of body weight of sodium, chlorine and sulphur for the period investigated has a tendency to decrease, while nitrogen and potassium show a marked increase. Calcium and phosphorus concentrations show first a marked decrease and then a tendency to increase.

Calcium and Phosphorus Metabolism in a Patient with Albers-Schönberg Disease. (Donovan J. McCune and Charles Bradley, Am. J. Dis. Child., December, 1933): Albers-Schönberg disease is a rare combined disease of the skeleton and of the hematopoietic apparatus which was first described in 1904 by the German roentgenologist whose name it bears. It is also known as "Marmorknochenkrankheit," "marble-bone disease" and "osteopetrosis." It is characterized essentially by increased thickness of the cortical and spongy portions of the entire osseous system. Roentgenographically, the individual bones appear opaque and lacking in finer structure. Anemia is frequently present. Other manifestations are: multiple pathologic fractures, chronic osteomyelitis, hydrocephalus, optic atrophy and enlargement of the liver and spleen and superficial lymph nodes. The disease shows a strong familial tendency and is occasionally hereditary. Sixty-five cases have been reported to the present time. Our patient was a 5 month old girl whose parents were first cousins. There were no other cases of the disease in the family. The patient presented the following symptoms: malnutrition, underdevelopment, florid rickets, optic atrophy, blindness and enlargement of the liver and spleen and superficial lymph glands. Severe anemia was present, with thrombocytopenia. There was persistent leukocytosis.

Dental Foreign Body in the Air Passages (Julian L. Rogatz, Arch. Pediat., abstr. Am. J. Dis. Child., January, 1934): The author urges that early roentgenography and bronchoscopy be utilized in an effort to ascertain the presence of a foreign body suspected from the history and physical assigns, in order to assure a favorable prognosis in what might otherwise prove to be a fatal case. He calls attention to the danger of aspirated dental material and reports a fatal case in which a child aspirated a molar tooth.

Osteomyelitis of the Upper Jaw in Three Infants (W. Herzau, Klin. Monatsschr. f. Augenh.; abstr. Am. J. Dis. Child., January, 1934): The author states that until recently the subject of osteomyelitis of the upper jaw in infants has not been found much in ophthalmic literature. He mentions the articles of D. Bosse and Remky. He thinks that in the majority of the cases the ocular symptoms dominate the picture, and that the disease is so rare and the signs so varied as to cause difficulty, leading to errors in the proper operative handling which make the prognosis unfavorable. He mentions the possible etiologic factors, namely, an infection in the alveolar border, especially caused by mastitis in the mother, and the rhinologic cause. The clinical picture shows severe swelling, chemosis, exophthalmos with limitation of motion and fistula, mostly in the infra-orbital margin, in the corner of the eye, in the hard palate, in the alveolar process and, in rare cases, in the nose. The disease is to be differentiated from phlegmon of the tear sac chiefly by its site. The swelling, as a rule, is more severe in the eyelid than over the tear sac. In many cases, it is most difficult to differentiate the condition from orbital phlegmon; nevertheless, it

can be recognized from the site of the fistula, the lack of swelling of the upper jaw and the purulent secretion in the nose. Frequently, there results metastatic suppuration in other bones and organs, as for example in the brain and lungs, so that a mortality of 29 per cent is not to be wondered at. As an ocular complication, optic atrophy has been described. The therapy consists in the widest possible removal of the infected region through an operative opening, which, for cosmetic reasons, should be done from within when possible. The author reports three cases. The first case occurred in a child, 6 months old, presenting typical symptoms. An incision into the lower orbital margin disclosed pus, but recovery followed only after radical removal of the tooth bud by the rhinologist. The second case was that of a child, 4 weeks old, who for two weeks had had redness and swelling of the right lower lid which had been treated by an ophthalmologist as a phlegmon of the tear sac. This case presented typical symptoms with high fever. An incision in the lower lid yielded foul-smelling pus. Besides this, there was bilateral otitis media. With the child under ether anesthesia, the rhinologist made an incision in the upper jaw. Two free sequestrums and a tooth bud were removed. Soon a fistula appeared in the lower orbital margin; later this was incised and a further sequestrum removed. Recovery ensued. The third case was that of a child, 6 weeks old, who had been sick for a week. The upper lid was swollen, with induration of the lower lid, especially in the region of the tear sac. In the conjunctival sac, there was pus. The eyeball was protruded without chemosis or any other abnormal findings. The upper jaw was swollen on the right side, and a purulent secretion was found in the nose. Under ether anesthesia, an incision was made through the face over the upper jaw, and considerable pus was evacuated along with a tooth bud. Recovery with optic atrophy resulted. In discussing the cases, the author stated that the external incision in two children resulted in no cosmetic defects. Whether the removal of the tooth bud can lead to a deformity of the upper jaw as a result of the decreased development on the diseased side only the future can show. In the first child, several years later there was no deformity.

Peculiarities of Osteomyelitis in Early Childhood (Gunther Baschlau, Monatschr. f. Kinderh.; abstr. Am. J. Dis. Child., January, 1934): A complete and interesting study is given of forty-two cases of osteomyelitis in the Finkelstein clinic. The characteristic of this disease in nurslings is its tendency to localize in the epiphyses. From here, the disease rapidly spreads to involve the joints, although one in three or four cases may lead to metastases. The disease is always much more acute in children than in adults. Seldom does one see the chronic fistula and elimination of sequestrums. The clinical course varies from mild cases to those of the severe, septic, toxic type. The mortality rate is reported as about 66 per cent, but with the treatment advocated, twenty-six of the forty-two patients at the clinic were saved. The article describes unusual locations of infection, such as the skull, and the upper and lower jaws, with case reports. The treatment is preeminently conservative. One should never be too hasty, but should wait until the abscess is completely formed, and then open it without disturbing the bone. Even when the joint is involved, better results are obtained by aspiration repeated several times. Even purulent joints of small children have a great tendency to heal without functional disturbance, if one does not injure the synovia with hard drains. Again in this procedure, great conservatism must be employed, and the phlegmon opened without opening the joint.

Contribution of Pediatrics to Dental Health (Royal Storrs Haynes, New York State J. Med.; abstr. Am. J. Dis. Child., January, 1934): Ninety-five per cent of the 45,000,000 children of this country are said to have dental caries, and 85 per cent, defects of occlusion. The child with dental caries has imperfect nutrition. The pediatrician knows that positive harm may result from poor teeth, and his work in nutrition should make it possible to prevent much of this dental trouble.

Relation of Diseases of the Mouth and Teeth to Pediatrics and Internal Medicine (William D. Tracy, New York State J. Med.; abstr. Am. J. Dis. Child., January, 1934): Teething usually causes no symptoms, but irritation, inflammation due to pressure and swelling may be marked, and may produce symptoms. In certain cases, difficult dentition assumes a real and sometimes a serious aspect. The child's teeth should be examined by a dentist at 2½ or 3 years of age and every six months thereafter. Dental caries is a serious matter and is the most prevalent and widespread of all human diseases. Every effort should be made to protect the deciduous teeth. The death of pulp in the mouths of adolescent patients, formerly considered lightly, "is now regarded as nothing short of a tragedy." The causes

and prevention of dental caries are still unsolved problems. The dietetic approach is now dominant. If this enigma is to be solved, the dental profession must have the assistance of physicians.

Antirachitic Potency of the Milk of Human Mothers Fed Previously on Vitamin D Milk of the Cow (John W. M. Bunker, Robert S. Harris and Richard S. Eustis, New England J. Med., abstr. Am. J. Dis. Child., February, 1934): According to Hess, Lewis, MacLeod and Thomas, vitamin D cow's milk, when fed directly to infants, will cure or prevent rickets. A group of mothers was given 24 ounces (680.3 c.c.) of vitamin D milk daily in addition to the regular diet, but no cod liver oil, viosterol or other antirachitic supplement was used. A control group received no vitamin D milk. It was found that the breast milk of mothers to whom antirachitic supplements to a mixed diet had not previously been given did not heal rickets in rats when 20 c.c. of milk per animal per day was fed for eight days. The breast milk of mothers to whom 24 ounces of vitamin D milk had been given daily for two weeks as an antirachitic supplement to an otherwise adequate diet was found to have an antirachitic potency equivalent to 1 rat unit in 136 c.c. of breast milk (17 c.c. per rat per day for eight days). The authors conclude that the antirachitic potency of human breast milk can be augmented in a simple and acceptable manner by including vitamin D milk in the diet of the mother during lactation.

Etiology of Primary Granucytopenia (Agranulocytic Angina) (F. W. Madison and T. L. Squire, J.A.M.A., March 14, 1934): The two authors review the history of the disease and tabulate their observations. They contend that they do not believe the small number of cases reported in earlier days—prior to 1922—was due to diagnostic error. The symptoms are too pronounced. In six years, since 1927, more than 500 cases have been recorded. Previous to that time, there were only forty-five cases in the literature. The period of rapid increase coincides with the increase in the case of drugs containing amidopyrine with a barbiturate. Also the disease has a high incidence among people given to taking drugs and among physicians, physicians' wives, nurses and physicians' patients, also among people having pain and therefore under a physician's care. In each of fourteen cases, the onset of primary granulocytopenia was directly preceded by the use of amidopyrine alone or with a barbiturate. The mortality among six patients who continued to use drugs containing amidopyrine was 100 per cent. In a group of eight who did not continue to use it, two died, but in the initial attack. A single dose of amidopyrine to each of two patients who had recovered from the acute disease was followed by a profound fall in granulocytes. The authors believe amidopyrine alone or in combination with a barbiturate is capable of producing primary granulocytopenia.

Foreign Literature

Full Temporary Dentures, with Special Reference to Their Function and a Review of the Merits of Immediate Denture Service (A. G. Allen, Brit. D. J., Jan. 15, 1934): Allen would weigh the values of temporary denture service and immediate denture service with its accompanying alveolectomy. He notes the plea of indispensability of dentures in one case and the wait of months for dentures in another, the disparity of service being based on social standing. He bases his argument on whether immediate replacement of teeth is necessary. This only, he contends, is the proper working base. There is such a need, better met by temporary dentures after extraction or immediate denture service following alveolectomy. Coincidently, it must be settled as to whether it is right or wrong for patients to be made edentulous for a long period, or, in other terms, whether immediate replacement is a luxury or a necessity. He assesses the natural teeth to gage the estimate of their loss. He tabulates the effects of their removal. He disapproves the use of the terms "temporary" and "permanent." He argues that the immediate insertion of full dentures and the question of immediate replacement be put on a sound basis. The patient must be educated to its importance. He would obviate the arguments of economy and inconvenience. His next question, as to whether alveolectomy is to be done, he approaches differently. His opinions are divided. He opposes the factor of safety in alveolectomy to that in natural absorption. He considers all arguments for and against this procedure and discusses them under pathologic, esthetic and prosthetic. Alveolectomy is defined as the removal of that precise amount of bone which would be absorbed during the healing process. Allen notes the difficulty of this prognosis. If rebasing is necessary, the prosthetic argument fails. He concludes that surgical treatment for prosthetic purposes is an admission of weakness. No aveolar surgery save the re-

moval of interdental points will improve on nature's product. He concedes alveolectomy to the anterior tooth area for esthetic purposes.

Evidence of a Probable Relationship Between Tropical Ulcer and Vincent's Infection (F. N. Clements, D. J. Australia, Jan. 1, 1934): Clements seeks to demonstrate a relationship between tropical ulcers which are indigenous to humid tropical areas and appear over the tibia usually below the knee and Vincent's infection. The ulcer is phagadenic in character, sloughs and spreads to muscles and bones. Left to itself, it shows small tendency to heal. He admits the absence of some links of comparison so selects the outstanding features. The similarities are: sudden onset, odor, ready bleeding, effects of age and a similar symbiosis of fusiform bacillus and spirochetes. Also, the pseudomembrane containing the same bacterial forms characterize both.

Investigations Concerning Transparent Dentin (P. Kimmelstiel and E. Langemak, Vierteljhrsschr. f. Zahnhlk., 1933, p. 433): A study of micro-incinerated sections shows that transparent dentin is characterized by an increased deposition of calcium salts. Chemical analysis and progressive micro-incineration show that there is also an increase in organic substance in the transparent zone. The authors are not ready to explain the chemical nature and the localization of the increased organic substance.

Experimental Rickets and Its Dental Significance (T. Dobkowsky, Vierteljhrsschr. f. Zahnhlk., 1933, p. 323): Experimental and human rickets, though very similar, are not identical. In the rat, rickets heals more quickly and can be prevented much more easily. In human rickets, therapy alone is not sufficient, because social conditions often play a chief rôle.

Biology of the Pulp (Guido Fischer and Hans Schmalfuss, Zahnarztl. Rundsch., 1932, pp. 1685-1692, 1761-1769, 1809-1815, 1858-1868, 1901-1910, 1933-2000): Fischer claims that it is very difficult to find a well formed, normal pulp. He investigated the conditions of pulps, in teeth free from caries, in patients of various ages and of different health conditions. He found that the first disturbance occurs in the capillary system, subsequently spreading to the first layer of odontoblasts. This is due to the fact that the dentin as well as all the tooth structures are dependent on the body metabolism, and a dysfunction of the latter disturbs the former. Various stimuli act on the tooth from the time of eruption till its articulation. The quality, time and strength of these stimuli act differently on the pulp. There exists, therefore, a continuous change of external and internal environments in the life of the pulp. The calcium metabolism is the most important factor in the primary function of the pulp, that is, to build dentin. The authors also investigated the relation between the endogenous disturbances of the pulp metabolism and paradentosis; also what changes occur in the pulp during the existence of paradentosis. They found more or less serious changes in the structure of the pulps. In serious cases of paradentosis, after the destruction of the odontoblasts and pulp cells, there remains a small number of blood vessels and nerve endings which maintain a varied metabolism. The pulp and the periodontium are in very close metabolic relationship. Any disturbance reacts equally on both. The only difference between these two structures is that the periodontium, owing to its rich collateral circulation and favorable structure, is able to withstand greater disturbances than is the pulp. As the first symptom of all periodontally diseased teeth, the authors found congestion in the apical region of the pulp. The structural changes in the pulp are influenced mainly by the structure of the root section. To prove their point, the authors studied the pulps of teeth in the periodontal area of which local inflammatory disturbance was induced experimentally. They did not reach any universal conclusions. They also studied the physicochemical changes in pulps of healthy teeth and in the presence of paradentosis and found that they have an extreme basic reaction (p_H 7.4).

Swelling in Early Childhood Originating from Tooth Disturbances (H. Euler, Deutsch. Zahnarztl. Wchnschr., 1933, pp. 206-213, 228-234): The author discusses the following swellings in childhood having their origin in dentition: 1. Follicular cysts, which are very rare in early childhood, a few cases being found in literature. 2. Congenital epulides. Perthes reports seven cases. No other reports are found. The author questions the correctness of Perthes' diagnosis. 3. Adamantinomas. Statistics mention only one (Coste, 1861) in a child 6 months old. The author diagnosed another case in a child 13 months old. 4. Odontomas. Only one case is reported, that of a child 5½ months old (Mummery and Pitts, 1926). It is doubtful whether that case cannot be included under adamantinomas. The author had seen another case lately, that of a child 19 months old.

Changes in the Periodontium Due to Re-

duction in Pressure (Jozat Rudolf, Dtsch. Zahnarztl. Wchnschr., 1933, pp. 155-157): The author measured the width of the periodontal space between the cementum and the alveolar bone, on cadavers. He established that there is a widening of the periodontium with increased age. Teeth functioning well have a greater space than those of lesser function. Teeth serving as prosthetic abutments have the largest periodontal width. In an even flat cutting bite of the anterior teeth, the periodontal width is greater than in a deep bite.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Asociation, St. Paul, Minn., August 6-10.

American Dental Society of Europe, Holland, August.

American Public Health Association, Pasadena, Calif., September 3.

Association of American Women Dentists, St. Paul, Minn., August 6.

American Society of Oral Surgeons and Exodontists, St. Paul, Minn., August 3-4.

Canadian and Ontario Dental Associations, Toronto, May 21-23.

Congress of Radiology, Zurich, Switzerland, July 24-31.

Great Lakes Association of Orthodontists, Toronto, Canada, May 7-8.

International Congress of Radiology, Zurich, Switzerland, July 24-31.

Society for Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

Southern Society of Orthodontists, Hot Springs, Va., July 16-17.

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

American Dental Hygienists Association, St. Paul, August 6-10.

STATE SOCIETIES

April

Alabama, at Montgomery (23-25)
California, at San Francisco (5-7)
Connecticut, at New London (18-20)
Kentucky, at Louisville (9-11)
Louisiana, at Shreveport (19-21)
Michigan, at Grand Rapids (9-11)
Mississippi, at Jackson (16-18)
Montana, at Missoula (12-14)
New Jersey, at Atlantic City (25-27)
Tennessee, at Chattanooga (26-28)
Texas, at Forth Worth (24-26)
Virginia, at Charlottesville (30-May 2)
Wisconsin, at Milwaukee (17-19)

May

Arkansas, at Little Rock (14-16)
Illinois, at Springfield (8-10)
Indiana, at Indianapolis (21-23)
Iowa, at Cedar Rapids (1-3)
Kansas, Missouri and Oklahoma (Tri-State) 6-9
Maryland, at Baltimore (7-9)
Massachusetts, at Boston (7-9)
Nebraska, at Lincoln (21-24)
New York, at Buffalo (9-12)
Pennsylvania, at Pittsburgh (1-3)
South Dakota, at Mitchell (7-8)
Vermont, at Burlington (16-18)
West Virginia, at Clarksburg (21-23)

June

Southern California, at Los Angeles (4-6)
Georgia, at Atlanta (11-13)
Maine, at Augusta (22-23)
New Hampshire, at Lake Sunapee (27-28)
North Carolina, at Wrightsville Beach (18-20)
Oregon, at Portland (20-23)
Washington, at Tacoma (14-16)
Wyoming, at Cheyenne (22-23)

STATE BOARD OF DENTAL EXAMINERS

Arkansas, at Little Rock, June 18-21. Clarence W. Koch, Secretary, 817 Doneghey Bldg., Little Rock.

New Jersey, at Trenton, June 25-30. John C. Forsyth, Secretary, 148 W. State St., Trenton.

California, at San Francisco, May 21, and Los Angeles, June 18. Kenneth I. Nesbitt, Secretary, 450 McAllister St., San Francisco.

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

Connecticut, at Hartford, June 27-30. Almond J. Cutting, Recorder, Southington.

Delaware, at Wilmington, June 20-21. W. S. P. Combs, Secretary, Middletown.

Indiana, at Indianapolis, June 12-17. J. M. Hale, Secretary, Mt. Vernon.

Kentucky, at Louisville, June 5-8. Robert L. Sprau, Secretary, 970 Baxter Ave., Louisville.

Maine, at Augusta, June 25-27. Alton H. Swett, Secretary, 192 State St., Portland.

Mississippi, at Jackson, June 19-21. T. Ford Leggett, Secretary, Laurel.

Montana, at Helena, July 9-12. Leonard A. Jenkin, Secretary, Medical Arts Bldg., Great Falls.

Ohio, at Columbus, June 25. Morton H. Jones, Secretary, 1553½ N. Fourth St., Columbus.

Pennsylvania, at Philadelphia and Pittsburgh, June 19-23. W. A. McCready, Secretary, 1115 Highland Bldg., Pittsburgh.

Rhode Island, at Providence, June 26-28. Albert L. Midgley, Secretary, Union Trust Bldg., Providence.

South Dakota, at Sioux Falls, June 28-30. John J. Berry, Secretary, Deadwood.

Tennessee, at Memphis, June 11-16. B. C. Gallimore, Secretary, McKenzie.

Texas, at Houston. J. T. Edwards, Secretary, 1315 Medical Arts Bldg., Fort Worth.

Vermont, at Montpelier, June 25-27. H. B. Small, Secretary, Burlington.

Virginia, at Richmond, June 12. John M. Hughes, Secretary, Medical Arts Bldg., Richmond.

Wisconsin, at Milwaukee, June 18-22. S. F. Donovan, Secretary, Tomah.

MARYLAND STATE DENTAL ASSOCIATION

The next annual meeting of the Maryland State Dental Association will be held, May 7-9, at the Lord Baltimore Hotel, Baltimore.

JAMES H. FERGUSON, JR., *President,*
Medical Arts Bldg.,
Baltimore.

NEW JERSEY STATE DENTAL SOCIETY

The sixty-fourth annual meeting of the New Jersey State Dental Society will be held at the Ambassador Hotel, Atlantic City, April 25-27.

F. K. HEAZELTON, *Secretary,*
223 East Hanover St.,
Trenton.

SOUTH DAKOTA STATE DENTAL SOCIETY (CHANGE OF DATES)

The South Dakota State Dental Society will meet in Mitchell, May 7-8, instead of May 14-15 as previously announced.

ERNEST W. ELMEN, *Secretary,*
Sioux Falls.

ARKANSAS STATE BOARD OF DENTAL EXAMINERS

The next examination of applicants to practice dentistry in Arkansas will be held at the Marion Hotel, Little Rock, June 18-21; fee, $35. Applications must be filed at least ten days prior to date of examination. For further particulars address

CLARENCE W. KOCH, *Secretary,*
817 Doneghey Bldg.,
Little Rock.

DELAWARE STATE BOARD OF DENTAL EXAMINERS

The next meeting of the Delaware State Board of Dental Examiners will be held June 20-21, at the Delaware Hospital, Wilmington. For further information, address

W. S. P. COMBS, *Secretary,*
Middletown.

INDIANA STATE BOARD OF DENTAL EXAMINERS

The Indiana State Board of Dental Examiners will hold its next regular examination in Indianapolis at the Indiana University School of Dentistry commencing June 12 and continuing for probably five days thereafter. Applications should be filed ten days before date of examination. For application blanks and further particulars, address

J. M. HALE, *Secretary,*
Mt. Vernon.

KENTUCKY BOARD OF DENTAL EXAMINERS

The annual examination of the Kentucky State Board of Dental Examiners will be held June 5-8, at Louisville.

ROBERT L. SPRAU, *Secretary,*
970 Baxter Ave.,
Louisville.

MONTANA STATE BOARD OF DENTAL EXAMINERS

The next annual meeting of the Montana State Board of Dental Examiners will be held at Helena, July 9-12.

LEONARD A. JENKIN, *Secretary,*
Medical Arts Bldg.,
Great Falls.

PENNSYLVANIA STATE BOARD OF DENTAL EXAMINERS

The Pennsylvania State Board of Dental Examiners will hold its next examination, June 19-23, at Philadelphia and Pittsburgh.

W. A. McCready, *Secretary*,
1115 Highland Bldg.,
Pittsburgh.

SOUTH DAKOTA STATE BOARD OF DENTAL EXAMINERS

The next meeting of the South Dakota State Board of Dental Examiners will be held at the Carpenter Hotel, Sioux Falls, June 28-30. Applications, with necessary fee, must be in the hands of the secretary at least ten days prior to date of examination.

John J. Berry, *Secretary*,
Deadwood.

TENNESSEE BOARD OF DENTAL EXAMINERS

The next meeting of the Tennessee Board of Dental Examiners will be held at the College of Dentistry, Memphis, during the week beginning June 11. Applications, with fee and photograph, must be in the hands of the secretary at least ten days before date of meeting. For further information, apply to

B. C. Gallimore, *Secretary*,
McKenzie.

TEXAS STATE BOARD OF DENTAL EXAMINERS

The next meeting of the Texas State Board of Dental Examiners will be held in Houston, June 25-29. There is no reciprocity.

J. T. Edwards, *Secretary*,
1315 Medical Arts Bldg.,
Fort Worth.

VERMONT BOARD OF DENTAL EXAMINERS

The Vermont State Board of Dental Examiners will meet June 25-27 at the State House, Montpelier, to examine applicants for license to practice dentistry and dental hygiene. All applications, accompanied by examination fee, must be in the hands of the secretary at least ten days before date of meeting. For applications and other information, address

H. B. Small, *Secretary*,
Burlington.

WISCONSIN STATE BOARD OF DENTAL EXAMINERS

The Wisconsin State Board of Dental Examiners will hold its next examination June 18-22 at the College of Dentistry, Marquette University, Milwaukee. All applications and fees must be in the hands of the secretary ten days before date of examination. For applications and further information, address

S. F. Donovan, *Secretary*,
Tomah.

GREAT LAKES ASSOCIATION OF ORTHODONTISTS

The annual meeting of the Great Lakes Association of Orthodontists will be held at the Royal York Hotel, Toronto, Ontario, May 7-8. An invitation is extended to all ethical members of the dental and medical professions.

Ralph P. Howarth, *Secretary*,
1140 Hanna Bldg.,
Cleveland.

AMERICAN DENTAL HYGIENISTS' ASSOCIATION

The eleventh annual convention of the American Dental Hygienists' Association will be held in St. Paul, Minn., August 6-10. Headquarters will be the St. Francis Hotel.

Agnes G. Morris, *Secretary*,
886 Main St.,
Bridgeport, Conn.

CANADIAN AND ONTARIO DENTAL ASSOCIATIONS

The convention of the Canadian and Ontario Dental Associations will be held in the centennial city of Toronto during Carnival Time, May 21-23. Guests will be welcomed.

Fred J. Conboy, *Secretary*,
86 Bloor St., West,
Toronto, Canada.

CHICAGO COLLEGE OF DENTAL SURGERY ALUMNI ASSOCIATION

The fifty-first annual meeting of the Alumni Association of the Chicago College of Dental Surgery will be held April 9-10, at the dental school. A banquet will be given the night of April 9 at the Blackstone Hotel in honor of Dr. John R. Watt, who has taught in the school thirty-eight years.

Ben H. Sherrard, *Chairman*,
Publicity Committee,
Rock Island, Ill.

AMERICAN DENTAL ASSOCIATION

St. Paul, Minn. Aug. 6-10, 1934.

HOTEL RESERVATION

In securing hotel reservations for the 1934 Session, consult the hotel rate-sheet and fill out the blank application below. Mail immediately to the hotel you wish to patronize. The hotel will then advise you of the reservation which has been made for you.

In case your first choice is not available, kindly indicate a second and a third choice. If none of these are available, the hotel manager will mail your application to the Chairman of Halls & Hotels Committee, who will make as favorable reservation for you as possible.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, namely, to occupy the room at the time agreed on, please write or wire the hotel, releasing the room reserved for you in order that it may be available to others attending the meeting.

MAIL THIS APPLICATION DIRECT TO THE HOTEL

HOTEL RESERVATION

AMERICAN DENTAL ASSOCIATION, ST. PAUL, MINN., AUGUST 6-10, 1934.

.....Hotel.

St. Paul, Minn.

Please reserve sleeping accommodations as noted below:

.....Room (s) With bath for.....people. Rate desired per day $.....

.....Room (s) Without bath for.....people. Rate desired per day $.....

Second choice hotel..... Third choice hotel.....

ROOMS TO BE OCCUPIED BY:	ADDRESS IN FULL
Applicant.....	.....
.....	.....
.....	.....
.....	.....

Please confirm this reservation to applicant. I further agree to notify the hotel at once in the event I am unable to use this reservation.

IMPORTANT TO HOTEL MANAGER: In the event you cannot accept this reservation, please forward this application at once to Dr. E. J. Simon, Chairman Halls & Hotels Committee, 364 Lowry Medical Arts Bldg., St. Paul, Minn., who will attend to the assignment of this reservation.

HOTEL	With Bath One Person	With Bath Two Persons	Without Bath One Person	Without Bath Two Persons
ANGUS				
165 Western Ave.	$2.50-3.00	$3.50	$1.50	$2.50
	3.50	4.00	2.00	3.00
ASTORIA				
374 Wabasha St.	2.00-2.50	3.00-3.50	1.00	1.50
		4.00-4.50		
COMMODORE				
79 Western Ave.	2.50-3.00	4.00TB*-4.50TB		
	3.50-4.00	5.00TB-5.50TB		
	4.50-5.00	6.00TB		
EUCLID				
405 N. Washington St.	2.00-3.00	3.00-4.00-4.50	1.25	2.00
FREDERIC				
45 East 5th St.	2.00-2.50	3.00-3.50-4.00	1.25-1.50	2.00-2.50
HOTEL JEWELL				
17 East 5th St.	2.00-2.50	3.50-4.00	1.00-1.50	1.50-2.00-2.25
HOTEL ST. FRANCIS				
7th & Wabasha	2.50-3.00	4.00-4.50-5.00TB		
	3.50	5.50TB-6.00TB		
HOTEL ST. PAUL				
363 St. Peter St.	2.50S-3.00	4.00S-5.00		
	3.50	6.00TB-7.00TB		
	4.00 T&S	8.00TB-9.00TB		
	4.50 T&S	12.00 Suites		
	5.00 T&S	15.00 Suites		
LOWRY HOTEL				
339 Wabasha St.	2.50 S	3.50-4.00		
	3.00 S	4.50-5.00		
	3.50-4.00	6.00TB-6.50TB		
	4.50 T&S	7.00TB-7.50TB		
	5.00 T&S	15.00 Suites		
	12.00 Suites			
MARLBOROUGH				
148 Summit Ave.	2.00-2.50	3.00-3.50		
PALMER				
321½ St. Peter St.			1.00	1.50
RYAN HOTEL				
402 Robert St.	2.00-2.50	3.00-4.00TB		
	3.00-4.00	5.00TB-6.00TB		
ST. PAUL ATHLETIC CLUB				
340 Cedar St. (Men only)	3.50			

*S, Shower; T&S, tub and shower; TB, twin beds.

LIBRARY BUREAU

A BIBLIOGRAPHY ON THE SOCIAL AND ECONOMIC PHASES OF DENTISTRY AND OTHER HEALTH SERVICES*

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*This bibliography is the result of a cooperative effort on the part of Dr. L. E. Kurth, Mrs. Josephine Hunt, Librarian of the American Dental Association, and Dr. H. E. Phillips, and is sponsored by the Economics Committee of the American Dental Association of which Dr. E. H. Bruening is chairman. Other members of the Committee are Drs. John T. Hanks, R. H. Miller, H. W. Oppice and Leland R. Packwood. The Committee recognizing the need of such a bibliography had arranged that the work be done in the American Dental Association Library. When it was learned that Doctors Kurth and Phillips had already started such a bibliography, a joint effort in completing the work was agreed on. Much of this material is available from the American Dental Association Library Bureau.

*Such topics as would be included under the subject headings voluntary insurance, compulsory insurance, state dentistry, state medicine and socialized medicine are included in the bibliography.

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